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Turn Sheaves at the Lake Mine

By Karl A. May*

Turn sheaves for guiding the hoisting ropes from the headframe sheaves to the hoist drums are in use at the Lake mine, in Michigan. These serve the same purpose as the turn sheaves described in the Journal of Nov. 9, 1912, by C. R. Forbes, but differ in design and method of installation.

The solution of the problem of finding the proper location, elevation and inclination for the sheaves and frames, was essentially as described by Professor Forbes, but a graphic solution was also made in order to check the computed results, and in addition a model was constructed, the details of which are shown and explained by Fig. 4. The model was put to good use throughout the process, in overcoming some of the difficulties attendant on using the third dimension, and in laying out to scale the existing conditions with a rather high degree of accuracy.

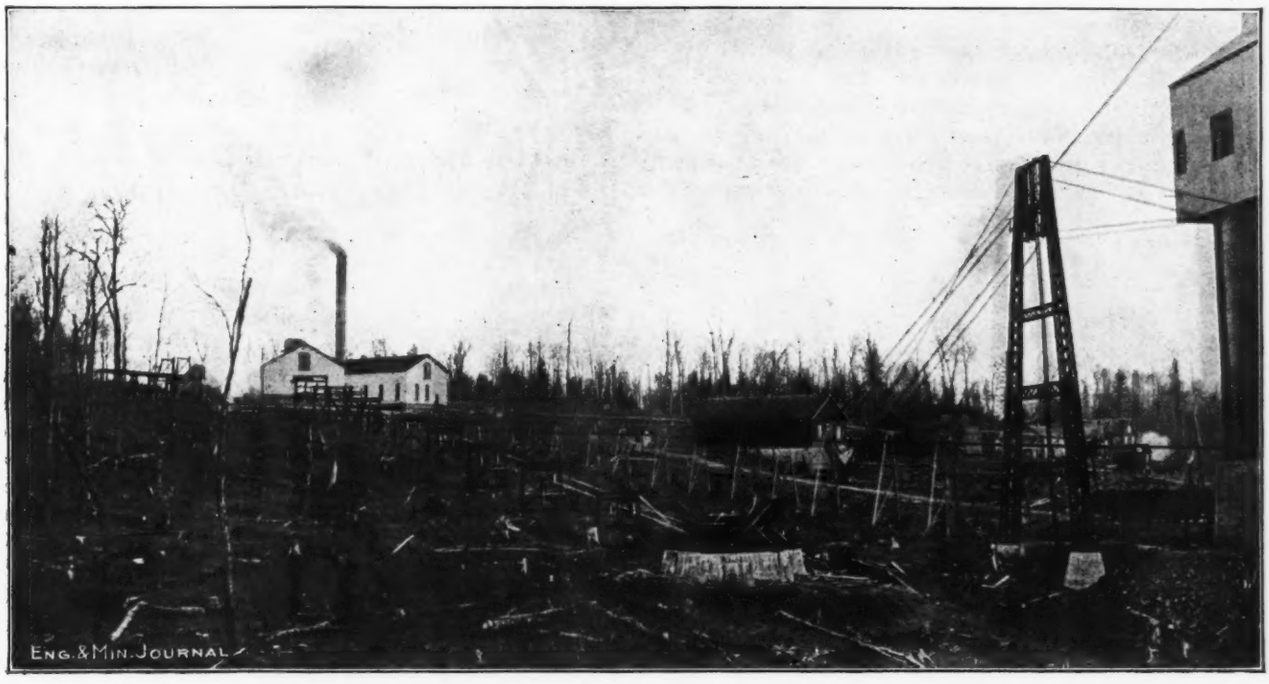

Fig. 1. Relation of Hoist House, Turn Sheaves and Headframe

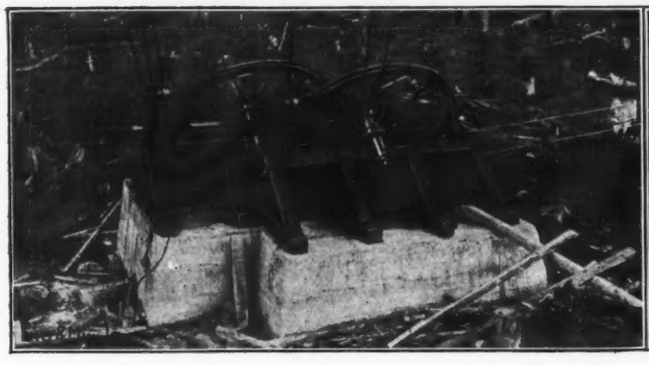

Fig. 2

Fig. 3

Turn Sheaves, Showing Guide Rollers and Lower Bearings

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The sheaves are set at an angle of about 48° with the horizontal. Separate calculations were made for each sheave, although a difference of only about 30′ in the angle of inclination resulted.

When the calculations were complete, the boss carpenter was given the two center lines of the foundation, a bench mark, and a print showing the location of the anchor bolts, and from these data he built the templates, which

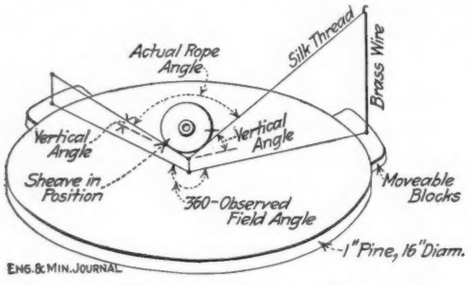

FIG. 4. MODEL FOR SHEAVE LOCATION

consisted of 2-in. planks, in which holes were bored for the anchor bolts. The planks were set to bring the bolts at the proper elevation. The latter were made with the lower end bent to a hook and an old 20-lb. rail was laid in each line of hooks.

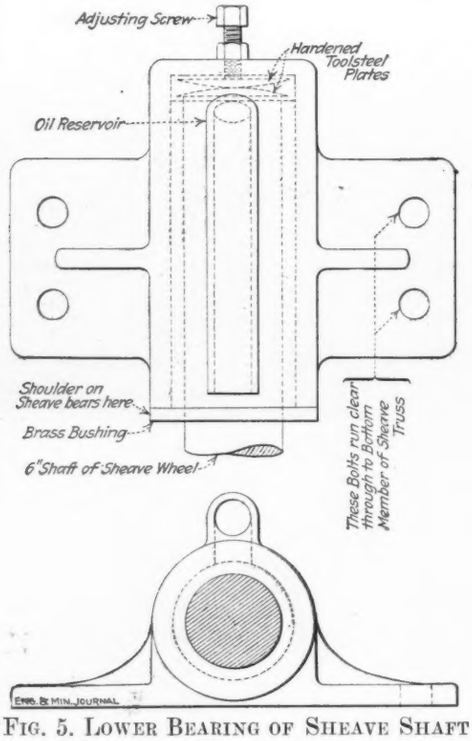
Adjusting Screw
Hardened Toolsteel Plates
Oil Reservoir
Shoulder on Sheave bears here
Brass Bushing
6" Shaft of Sheave Wheel
These Bolts run clear through to Bottom Member of Sheave Truss
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FIG. 5. LOWER BEARING OF SHEAVE SHAFT

The foundation is a level block of concrete with right-angled corners, but set at an angle of 4° 01′ from the line of the rope to the drums, as by this means the sills and the sheave frames are square with each other and with the foundation. The sills and frames are bolted together of 12x12-in. Oregon fir and tied with 1½-in. rods, the method of framing being shown by Figs. 2 and 3. The sheaves are 12 ft. in diameter, and the simple design with the accessible lower bearing is apparent from the illustrations. The details of the lower bearing, which is important, as it takes the greater part of the load, are shown in Fig. 5. Small guide pulleys are attached to the frames, where the ropes enter and leave the sheaves, to take up lash and prevent the ropes from jumping out, due to stretching or to sudden stopping and starting of the hoist.

As the turn sheave was placed 820 ft. from the drums and 150 ft. from the headframe sheaves, it was necessary to guide the ropes over these open spaces. Between the turn sheaves and the headframe, a tower with guide pulleys was set as shown in Fig. 1, and between the turn sheaves and the drums were built ten pulley stands. As the turn-sheave foundation was lower than the hoist drum, the pulley stand next to the power house was built stronger and higher to permit the ropes to clear the hoist foundation. Two 6-ft. sheaves were mounted on one shaft in each stand.

To give some idea of the stability and strength required in the sheaves, it may be stated that the hoist is of the Nordberg type, 32x72-in., duplex-cylinder, with double conical drums, designed to raise from a depth of 5000 ft., nine tons plus the weight of the skip and rope.

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Diamond and Gold Production of British Guiana

A gold production of 49,607 oz. is reported for British Guiana from July 1, 1911, to June 30, 1912, in a report issued by the Institute of Mines and Forests of that country. This production merely continues the steady decrease which has been recorded since 1893-94, when gold production in that country reached its maximum of 138,527 oz. Small scale alluvial mining has shown some increased activity in the prospecting line for the last year or two, and some new districts are reported. Two dredging companies continued fairly successful operations. The Guiana Gold Co., Ltd., for the time dealt with in the report, showed a total production of about 7408 oz., and declared a dividend of 10%. The Minnehaha Development Co., Ltd., showed a total production of 2029 oz., an increase over the previous year. A protracted drought interfered with the operations of both dredging companies, but it is stated that their success stimulated a demand for dredging ground and applications for concessions were received by the government.

No hydraulicking was done in the period reported on, the Tassawini Mining Co., Ltd., having gone into liquidation. The lode-mining industry was relieved of a burden of 70c. per oz. royalty. Operations were therefore continued on the Barima mine. For the last six months of 1911, this mine showed a production of 1161 oz. from 5757 tons, making a profit of $1528.

An increased output of diamonds was obtained, the Cuyuni district largely contributing to this result, although operations there were conducted in a small way and no systematic screening and concentrating was done. It is said to be established that the upper reaches of both the Mazaruni and Cuyuni Rivers are more or less diamondiferous. Stones from both districts have been found, ranging from one to four carats. The diamond output for the period covered was 81,034 stones, equivalent to 6977 carats. This is a considerable increase over the previous 12 months and larger than the year preceding that. The total production to date is given at 1,006,557 stones, weighing 74,203 carats. The diamond industry, as well as the gold, suffers from lack of transportation facilities.

Cyaniding Silver at Nevada Hills Mill

By Herbert A. Megraw

SYNOPSIS—A plant, situated in the Nevada desert, many miles from railroad communication, where all supplies have to be freighted in on wagons and passengers and mail carried by automobile stage. A sampling and weighing plant originally installed was abandoned as being superfluous. Classified concentration is practiced and all pulp is reduced to slime for agitation. A feature is the interrupted continuous-agitation series, solution wash being applied midway of treatment. Milling is in solution and no advantage has been found by heating the solutions above the normal. The counter-current decantation method is used to remove the principal portion of dissolved metal from the pulp and filtering is by the the Oliver continuous system. Merrill system of zinc-dust precipitation is used. Costs are exceedingly low considering capacity and situation of the plant.

The plant of the Nevada Hills Mining Co. is situated at Fairview, about 45 miles southeast of Fallon, Nev., the nearest railroad station. Due to the lack of immediate railroad communication the entry of supplies is slow and somewhat expensive. A line of automobile stages, however, makes passenger and mail transportation more easy and simple. The situation of the plant, so far removed from the railroad point, makes the obtaining and retaining of competent labor somewhat difficult. The fact that the company is the only one operating actively in the district does not help matters in this respect, and it is stated that the labor question is one of the important ones to be handled.

Nevada Hills Mill, Fairview, Nev.

Ores Varied in Character

The ores milled at the Nevada Hills mill vary in both character and hardness, but on the average may be said to be somewhat harder than the usual Nevada silver ores. In character they vary from clean, easily treated mineral to complex deposits, which give some trouble in beneficiation. The oxidized ores contain a certain quantity of manganese and are generally more difficult to cyanide than the sulphides, an extraction of 87% being usual on the former and on the latter 94% or more. Calculating on a basis of the average mill run an extraction of 92% is obtained. The mill treats from 120 to 140 tons per day, depending on the character of the rock. The proportion of silver is about as 100: 1, the ordinary mill heads averaging $20 to $22 per ton.

The mill is situated at the shaft head, thus obviating transportation difficulties, the mine skips dumping directly into a bin at the head of the mill. The mill building is a steel-frame structure covered with iron, substantial and well built.

Sampling and Weighing Plant Discarded

The ore coming from the mine is dumped into a 300-ton bin from which it is fed to a Blake crusher, the product of which passes over a shaking grizzly into an elevator. This elevator lifts the rock to a sorting and conveying belt, where the waste is taken out after the whole has been given a spraying wash, to facilitate the sorting operation.

The original design of the mill included at this point an automatic weighing device and sampling plant, but both of these have now been eliminated from the operat-

Note—This is the twelfth of a series of articles by Mr. Megraw on American cyanide practice. Previous articles appeared Nov. 2, Nov. 23, Dec. 14, Dec. 21, Dec. 28, 1912; Jan. 4, Feb. 8, Feb. 15, Feb. 22, Mar. 1 and Mar. 8, 1913.

ing plan and the passage of ore is as above stated. The reasoning leading to the abandonment of these steps is that the expense of operating them was more than any advantages gained from them. It is noteworthy that practically the same condition obtains at the mill of the Goldfield Consolidated, at Goldfield, where the extensive sampling plant originally built was never replaced after its destruction by fire.

Whether a sampling and weighing plant is worth its cost of installation is a question which seems to have been decided in the negative in recent years, although in former times such refinements were considered indications of approximate perfection. The system of calculating extraction percentages by using the sum of bullion output plus tailing content as the content of ore entering the mill has rendered sampling unecessary and weights can be approximated in some other more economical manner than by actually passing the mill run over scales. In speaking of the Tonopah mills I have already referred to this method and in writing on conditions at the Black Hills I mentioned the advisability of sampling and weighing plants for these mills. These later facts brought out by the investigation of further plants will modify the conclusions made earlier, but even at this time I do not feel altogether convinced that the methods so universally used at the present time are the best ones.

Methods of Calculating Extractions

The arguments used by adherents of the latest method of calculating extractions is that even with elaborate sampling plants it is difficult to obtain an accurate sample; that even if accurate samples are secured, they are liable to corruption through the inaccuracies of assaying, the fact being advanced that there is always a certain loss in assays and that the loss on the higher-grade samples, heads, is greater than on the lower-grade samples, tailing; and that the varying amount of metal contained in mill pulp and solutions makes accurate calculation an impossibility in any case. All these arguments, no doubt, have weight, although it does seem that some method of calculating a check could be devised.

As concerns sampling and weighing, I am convinced that by using properly designed apparatus in the hands of competent operators an accurate sample is possible. And also that chemical science is not so limited but that an exact estimation of the contained metal in any sample can be made. As to the conditions within the mills themselves, that is an entirely different matter and a question not so easily solved. In the older style of mill where sand and slime are treated separately, the slime going through the mill in three or four days while the sand portion remains in process of treatment as much as 15 days, it is evidently impossible to calculate extractions over a short period of time, although if the period be long enough a fair approximation of accuracy should be obtainable. In the newer mills treating all the ore as one product, calculations ought to be considerably simplified. In its present condition this question can hardly be considered definitely settled and I believe operators ought to discuss it publicly and see if some satisfactory solution cannot be advanced.

Chemical Consumption and Operating Cost

The consumption of material is about as follows: Cyanide, 2.7 lb.; lime, 9 lb.; lead acetate, 0.8 lb.; zinc, 1.5 lb. per ton; pebbles, 3 lb. per ton of ore milled. The cost of operation at the Nevada Hills mill is given completely in the accompanying table:

OPERATING COSTS AT NEVADA HILLS MILL

		Per ton ore milled
Crushing		
Labor	$0.052	
Repairs	0.003	
Power	0.016	$0.071
Stamping		
Labor	0.106	
Repairs	0.024	
Power	0.117	0.247
Concentrating		
Labor	0.087	
Material	0.011	
Power	0.021	0.119
Elevating and separating		
Labor	0.042	
Material	0.004	
Power	0.025	0.071
Assaying and sampling		
Labor	0.134	
Material	0.001	
Power	0.008	0.143
Tube milling		
Labor	0.040	
Material	0.104	
Power	0.149	0.293
Settling and agitating		
Labor	0.105	
Material	0.655	
Power	0.062	0.822
Continuous decantation		
Labor	0.020	
Material	0.004	
Power	0.008	0.032
Filtering		
Labor	0.096	
Material	0.028	
Power	0.052	0.176
Discharging		
Labor	0.066	
Material	0.046	
Power	0.013	0.125
Precipitation		
Labor	0.057	
Material	0.191	
Power	0.032	0.280
Refining		
Labor	0.073	
Material	0.077	
Power	0.003	0.153
Heating		
Labor	0.004	
Fuel (oil)	0.052	0.056
Water		0.005
Surface equipment		
Labor	0.007	
Material	0.003	
Power	0.004	0.014
General expense		
Labor	0.015	0.015
Total		$2.622

NOTE—Cost based on milling 4030 tons of ore in 30 days.

Crushing by Stamps

The ore ready for the mill is dumped into a 600-ton mill bin back of the batteries, into which it is fed through feeders of the Challenge type, but driving by means of a wire rope instead of the usual grip used on them.

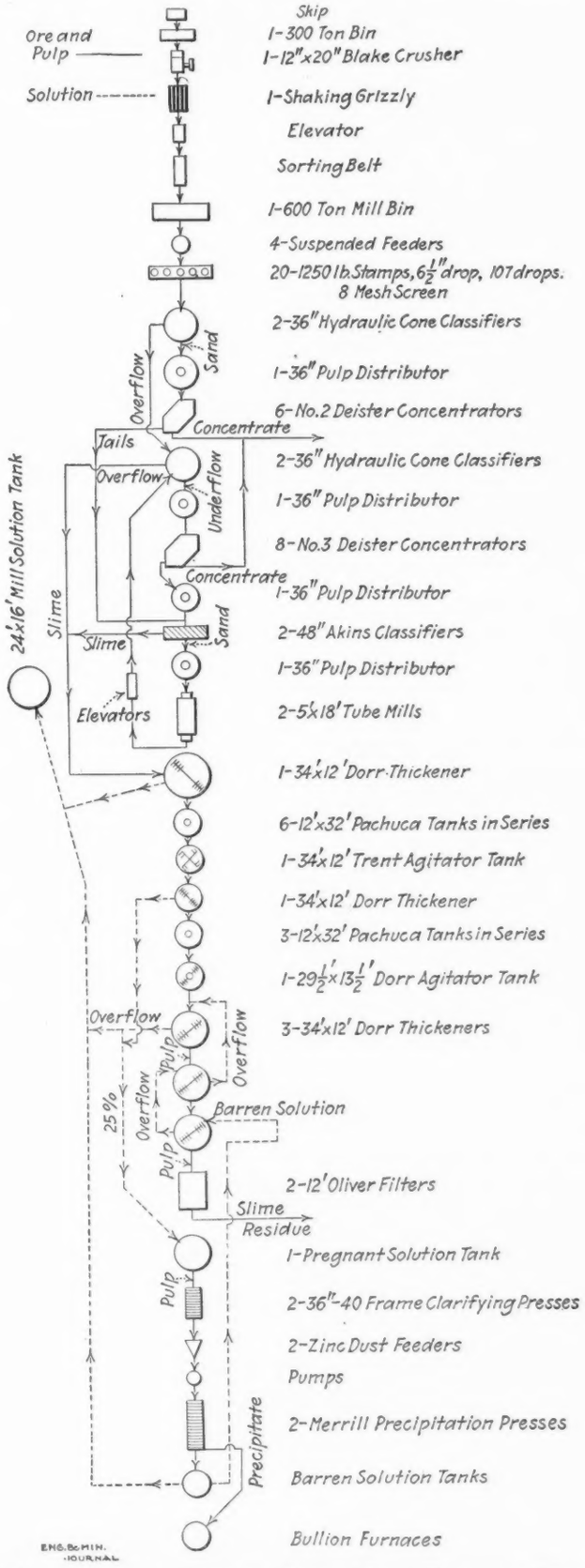
There are 20 stamps, each 1250 lb. in weight, making 107 drops through 6½ in. and crushing through 8-mesh screen. The pulp from the stamps is delivered into two cone classifiers, each 36 in. diameter, where it is divided into two portions, one containing the coarser sand and the other the finer part of the pulp.

Classified Concentration Followed

The underflow, or sandy portion, from the classifiers is passed to a pulp distributor, whence it is distributed to six No. 2 Deister concentrators, the overflow of the cone passing around this concentration system into a second battery of two hydraulic cone classifiers.

The tailing from the sand concentrators is passed to Akins classifiers. The overflow from the first classifiers

passes to the second battery, where the underflow, containing the heavier part of the pulp, goes to another pulp distributor and thence to eight No. 3 Deister concentrators. The overflow, consisting of slime ready for agitation treatment, goes directly to the first thickener, as will be mentioned.



FLOW SHEET OF NEVADA HILLS MILL, FAIRVIEW, NEV.

From the slime concentrators, the pulp with the concentrate removed, flows to a distributor which divides it in two and delivers to two 48-in. Akins classifiers, these being of the well known interrupted spiral flight type, the overflowing slime joining that coming from the second battery of hydraulic classifiers, while the sand is passed to another distributor which delivers to two tube mills, each 5x18 ft. The reground product from these mills is returned to the second battery of classifiers, where the slimed portion is taken out and the remaining pulp follows through the concentration and mechanical classification process. This procedure is shown in the accompanying flow sheet.

AN INTERRUPTED AGITATION SERIES

The slime for agitation is taken first to one Dorr thickener, 34x12 ft., where it is thickened from about 6:1 to 1:1. Issuing from this thickener, the pulp goes to the agitation series, before reaching which, however, it is diluted to 2 or 2½:1 by solution made up to treatment strength, which contains 5 lb. KCN per ton. The solution used throughout the mill averages 3 lb. per ton, all crushing being in solution.

There are nine agitation tanks of the Pachuca type, each 12 ft. diameter by 32 ft. deep. The pulp for treatment passes through six of these tanks in series, the flow being continuous. From these tanks it is taken to a Trent agitator tank, of the same size as the thickener, and thence to a 34x12-ft. Dorr thickener. Here the pulp is thickened again to about 1:1, and subsequently diluted with fresh made-up solution. The pulp then passes to another series consisting of three Pachuca tanks, of the same size as those formerly mentioned, through which it passes continuously.

This interrupted agitation series is especially worthy of note, as it accomplishes a continuous agitation and also a change of solution, a condition making for better extraction and one which I advocated some years ago for silver ores when continuous agitation was proposed but not generally practiced.[1] The advantage of a change of solution during a long agitation period is generally recognized and this method of accomplishing it can hardly fail to produce beneficial results.

WASHING BY DECANTATION

From the second agitation series the pulp is passed to a tank 29.5 ft. diameter by 13.5 ft. deep, in which is installed a Dorr agitating mechanism. In passing it is worth while to mention the working of this machine. It has two agitating arms which revolve at 4½ r.p.m., and the central air-lift pipe is 12 in. diameter. This air lift delivers the pulp to two arms suspended above the surface of the pulp in the tank and which revolve in unison with the submerged arms. The outside arms consist of a launder which carries the pulp from the air lift and drops it at various points over the tank surface, an arrangement of slots or openings allowing an equal distribution. It is stated that tests have shown that the pulp within this agitator maintains its homogeneity at all points within 2% when tested by specific gravity, pulp assay or screen test.

[1] "Continuous Processes," Mex. Min. Journ., August, 1910.

From this agitator the pulp passes to three Dorr thickeners, operated as a continuous-decantation system. The flow sheet illustrates the operation of this series which, it will be noticed, takes in barren solution at the final thickener and passes it back through successive tanks until is overflows at the first one, enriching itself and impoverishing the pulp. This is an exemplification of the proper working of the counter-current decantation method, of which I have already spoken. By its use an effective washing of the solids is accomplished and a lightening of the burden upon the filtering machine.

From the final thickener of the series the pulp is taken to two 12-ft. Oliver filters where final dewatering is done. A water wash is applied to the ascending side of the filter, but, none on the descend-side, as economy of water is necessary and by this means the discharged pulp contains a minimum of moisture. The slime is discharged upon a conveyor belt, by which it is carried clear of the mill and deposited on the tailing pile. It contains an average of 27% moisture. At this mill, in distinction to the experience of the Tonopah mills, no advantage is found from heating the solutions above normal.

Zinc-dust Precipitation

The solution to be precipitated is passed through clarifying presses and zinc dust is used to precipitate the metals. The precipitate is partially dried, fluxed and melted in oil-fired furnaces.

The lime used in treatment is added as an emulsion at the slime collector, the quantity being about 10 lb. per ton of ore milled.

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Johnson-Dragoon District, Arizona

Special Correspondence

The results of the deep explorations in the hanging wall at the Republic mine of the Arizona United Co. in the Johnson camp are apparently of considerable interest in the consideration of the future of the Johnson-Dragoon district. At this property, as with most of the others in the district, the first ore was found outcropping in a wide belt of altered lime shales, which followed a quartzite basement lying against a schist and granite core.

Oxidation extended to great depth, but ore generally was found not to continue very far from the surface outcrops. Lesser mineralization, entirely of the oxidized character, was found below the ore and in the footwall, but earlier development in the shale belt did not disclose any very satisfactory orebodies. The presence of a limited amount of sulphide minerals as replacement in the roof at depth, lead to explorations in the hanging wall with the result of disclosing below the 700-ft. level on the 40-deg. inclined shaft large bodies of copper-zinc-iron sulphide ore, apparently bedded with the altered lime shales, and extending with the flattened beds to depth. This ore is away from the altered mineralized footwall formation and seems to be distinct from the mineralization there. The sulphide ore is of good grade and carries a small amount of gold and several dollars in silver. It is in part accompanied by bands of the lime-iron-garnet formation characteristic of the altered shales, but in places is massive, showing a thickness of 10 ft. or more and a lateral extent of about 100 ft., as opened up at the time. The zinc is not uniformly distributed in the ore, but is sometimes as much as 10 or 15 per cent. Exploration is being conducted to define the extent of this new orebody. In the meanwhile the possibilities of deep explorations in the shale zone along the contact, which is exposed and mineralized to a greater or less extent for more than four miles, is being considered by other companies in the district.

The deep shaft of the Black Prince Co., about a mile northwest of the Republic, is idle. It was sunk nearly 1000 ft. in hard limestone and work was discontinued on reaching water. The shaft certainly shows splendid courage on the part of its projectors; as to their judgment, that is another matter. However, it is now proposed to drill from the bottom of the shaft and something may be found.

The Centurion in the Dragoon section is again planning resumption. The formation here is faulted, so that the white limestone overlying the shale, with an intervening several hundred of feet of black limestone, is pushed up against the inclined schist. The conditions have formed natural outlet channels for the underground waters and as a result, the limestone is chambered and pierced with tortuous channels to below the lowest or 600-ft. level.

These chambers are filled with iron oxide with a lining of green copper ores. Considerable ore has been shipped from the upper workings. In September, 1912, the American Metals Co., of New York, under the direction of Dr. Otto Sussman, undertook the exploration of this property, but after a limited expenditure, work was suspended without, however, exploring below water level or to the fault-line base. J. P. Richardson, the president of the company, is endeavoring to provide capital to continue the shaft below the water level and to install the necessary pumping equipment.

The old Peabody mine in the Johnson district is shipping in a small way. It is reported that an option on the company has been given to New York interests. This property lies in the limestone several hundred feet from the contact belt of the quartzite. It was very rich in copper, and has a record of more than a million dollars output from shallow works in the limestone. The relation of this orebody to that opened in the Republic mine is not clear. This relation will be a matter of interesting development.

Several properties in the vicinity of the Republic and Peabody mines are developing in a small way, awaiting the outcome of these properties. Between the Johnson camp and the Centurion, the Standard Mining Co., Owen T. Smith, president, has undertaken exploration of the shale belt by shafts through the thick overburden of wash. Across the flat from the Johnson-Dragoon mines is the Texas-Arizona Co., which is extracting lead-zinc ore with silver. This is apparently in a higher bed of the limestone formation than the other mines.

The district presents interesting geological features, and the recent developments are likely to lead to the investigation of conditions in depth by drilling through the limestone, an entirely feasible and justifiable plan.

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A List of Testing Laboratories is to be compiled by the new Austrian government "Technische Versuchsamt" (Michelbeuerngasse 6, Vienna), says "Engineering News." Private and public testing laboratories throughout the world are asked to send the "Versuchsamt" all pertinent information concerning their field of work, organization, commercial or educational affiliation, equipment, and extent of operations.

Pitot Tube in Gas Measurement

By C. E. McQuigg*

SYNOPSIS—The pitot tube, when correctly made, furnishes an accurate method of determining volumes of blast or flue gases. A problem in pitot-tube measurement worked out, and some helpful curves given for abbreviation of calculations.

The determination of either flue-gas or blast volume is often important to the metallurgist. The following notes are given on methods for determining flue-gas volumes, later, the application to blast measurements will be shown. Where there is no change of density in a gas, the velocity of flow is given by the formula $V^2 = 2gh$, where

V = Velocity of the gas in feet per second;
g = Acceleration of gravity in feet per second;
h = The equivalent head, or head in feet, of gas that will produce the given velocity, V = ft. per sec. (The above formula results, of course, from the law of falling bodies, $S = (h) = \frac{1}{2} gt^2$, $V = \frac{dS}{dt} = gt$, or substituting, $V^2 = 2gh$.)

The equivalent head is found by means of the pitot tube. This consists of a suitable tube—open at both ends—the flue end being terminated in a right-angle bend, as shown by Fig. 1. Various forms of static end have been designed, since the accuracy of the determination depends almost entirely on this. The impact end should exactly face the flow of gases, which should be free from eddies and surges. For this reason it is necessary to select a section of flue of uniform cross-section, avoiding nearness to sharp turns, bends or offsets. Just how near an obstruction the station may be placed, will depend chiefly on the velocity of the gases. This has been stated as 30 diameters of the flue for a right-angle bend in front of the pitot tube (i.e., facing the gas flow), and 10 diameters of the flue back of the station. This will be a matter for individual judgment and will be determined from consistent readings. The shape of impact tube is immaterial, just so that it is pointed directly to the flow. However, the edge of the tube should be filed or ground down to avoid loss of velocity energy at the shoulder.

Static End of the Pitot the Most Important Part of the Apparatus

As noted above, the design of the static end is probably the most important part of the apparatus, since the greatest danger of spoiling the results will be the liability of the static pressure to be vitiated by velocity energy. A moment's reflection will show that the failure to indicate the true static head will either enhance or diminish the indicated head due to velocity.

Obviously the maximum velocity will occur at the center of the flue, hence a number of readings should be taken, at various points in the cross-section, then integrate the areas and velocities. This may be done by dividing the cross-section into imaginary rectangles and taking readings at the centers of the rectangles. Or, a reading may be taken in the center of the flue and a coefficient of velocity applied. For large symmetrical flues of 100-sq.ft., or larger cross-section, unless the velocity exceeds 50 ft. per sec., the coefficient may be taken as unity. For small flues, several feet in diameter, the coefficient is usually taken between 0.9 and 0.95.

The manometer may consist of an ordinary U-tube or some such form as outlined in the illustration. It is connected to the pitot tubes by means of sound rubber tubing, the length being immaterial. The manometer is best sheltered from rapid changes of temperature and strong drafts. The pitot tubes must be placed firmly in position and the holes in the flue made air-tight.[1]

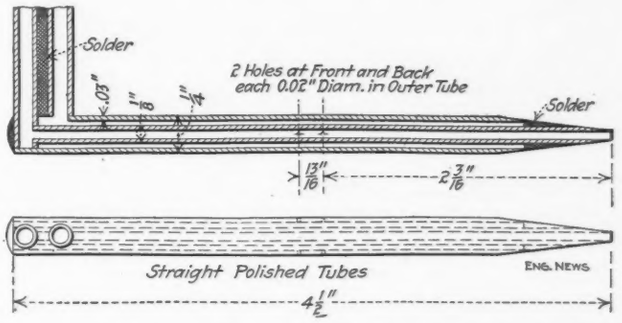

Fig. 1. Standard Pitot Tube for Air-measurement Work

Having made the measurements, the volume is calculated as follows: For example, assume a barometric pressure of 29.37 in. Hg, a flue temperature of 645° F., a static reading of 1.39 in. H_2O, and a velocity head of 0.19 in. H_2O, the manometer temperature being 67° F. (By velocity head is meant the impact head minus the static, or it is the head indicated when the tubes are connected properly, as shown in the sketch.)

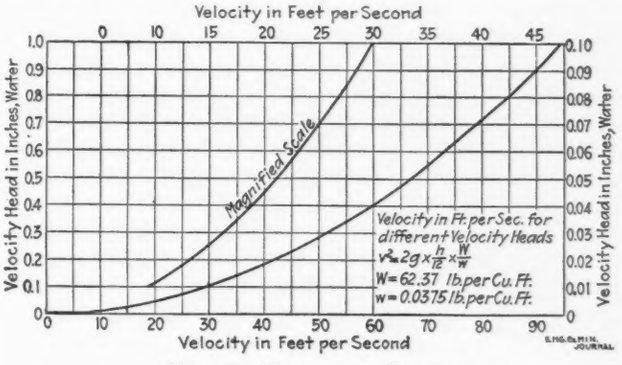
Velocity in Feet per Second
Velocity Head in Inches, Water
Magnified Scale
Velocity in Ft. per Sec. for different Velocity Heads
W = 62.37 lb. per Cu. Ft.
w = 0.0375 lb. per Cu. Ft.
Velocity in Feet per Second
Velocity Head in Inches, Water

Fig. 2. Velocity Chart

In order to obtain the equivalent head, it is necessary to know the ratio between the densities of the gases and the fluid in the manometer or U-tube. The flue gas may usually be treated as air, unless it contains a large amount of moisture. The weight in pounds of a cubic foot of dry air is given by the formula $w = \frac{1.3253 \times B}{459 + t}$, where B is the *absolute* pressure in inches of mercury and t is the

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[1] "Eng. and Min. Journ.," Dec. 17, 1910, p. 1197.

temperature in degrees Fahrenheit. In case it is desired to know the density of the actual gas it may be found from its chemical analysis.

Say the gas has the following composition by volume: CO_2, 4.0%; SO_2, 0.2; CO, 0.0; N, 77.9; O, 16.5; moisture, 1.4%. Multiply each per cent. by one-half the molecular weight of the gas, we get:

CO_2, 0.04 × 22 =	0.880
SO_2, 0.002 × 32 =	0.064
N, 0.779 × 14 =	10.906
O, 16.5 × 16 =	2.640
Moisture, 1.4 × 9 =	0.126
	14.616

The specific gravity of the above gas, referred to hydrogen as 1, is 14.62. The specific gravity of air at standard conditions, referred to hydrogen is 14.37. Then the weight per cubic foot of the above gas $= \frac{14.62}{14.37} \times$ the weight of one cubic foot of dry air for equal pressure and temperature. Hence the weight per cubic foot of any gas is $\frac{1.3253 \times \frac{m}{14.37} \times B}{459 + t}$, where m is the specific gravity of the gas referred to hydrogen as 1, as determined from its chemical analysis.

The equation reduces to

$$w = \frac{0.09223 \times B \times m}{459 + t} \text{ lb. per cubic foot}$$

Since the partial vacuum is in inches of water, and the formula is given for inches of mercury, the absolute flue pressure is $29.37 - \frac{1.39}{13.6} = 29.27$. (1 in. Hg = 13.55 in. H_2O.) Applying the above data, we get $w = \frac{0.09223 \times 29.27 \times 14.62}{459 + 645} = 0.03575$.

The fluid in the manometer may be water, alcohol, mercury, kerosene, etc., depending on the temperature of the outside air and the pressure value. Absolute alcohol is used in cold weather. It gives a slightly larger indicated head than water does for the same pressure values, since it has a specific gravity of approximately 0.81. If water is used, it may be colored by the addition of a pinch of organic dye; permanganate may be bleached by the gases, leaving a dirty stain on the tubes. The manometer temperature is obtained by an ordinary thermometer. The density of water in pounds per cubic foot for various temperatures is given in "Kent," p. 548, 7th edition. It is given as 62.33 lb. per cu.ft. at 67° F.

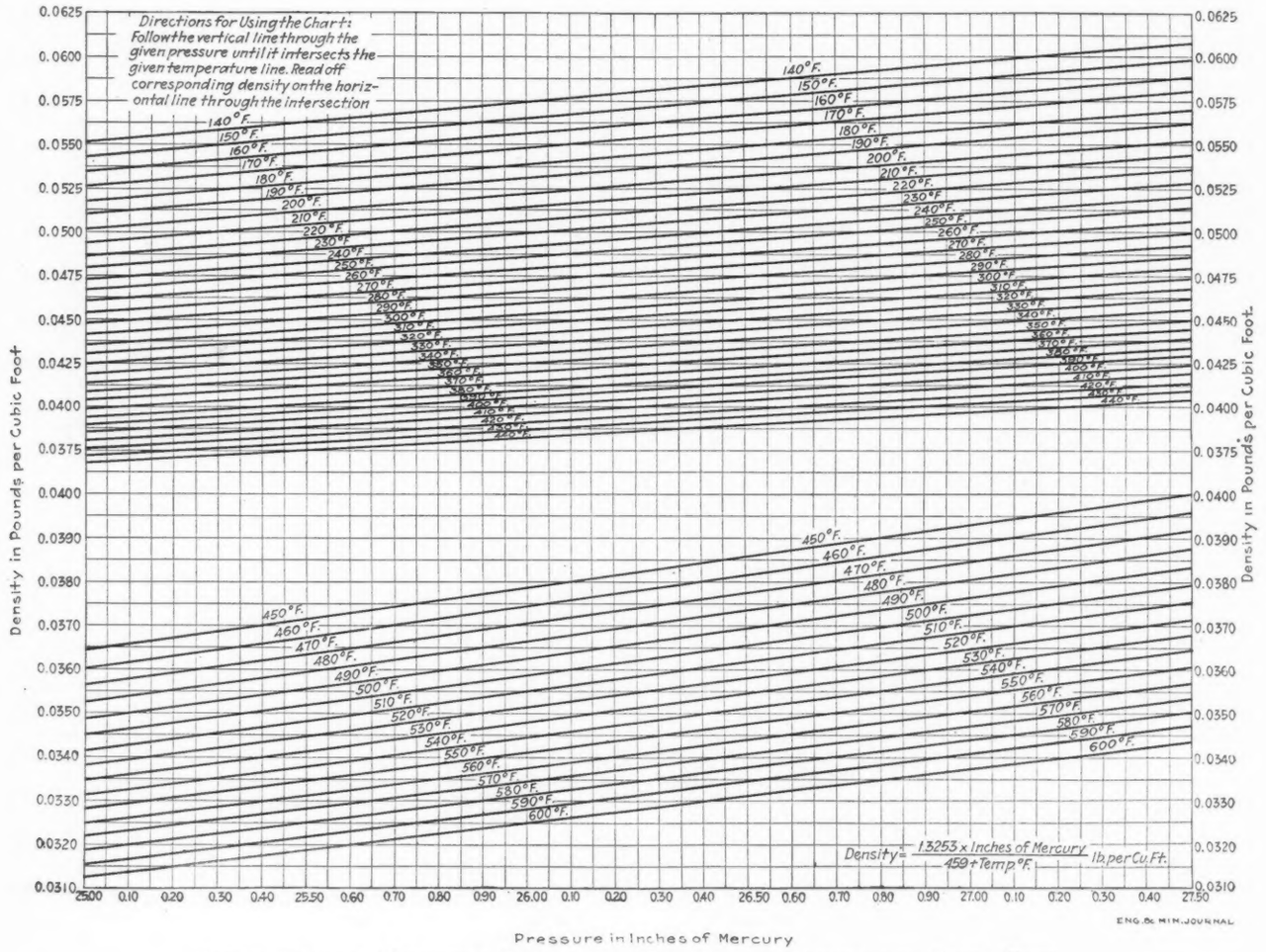
Directions for Using the Chart:
Follow the vertical line through the given pressure until it intersects the given temperature line. Read off corresponding density on the horizontal line through the intersection
Density = 1.3253 x Inches of Mercury / 459+Temp°F. lb. per Cu.Ft.
Density in Pounds per Cubic Foot
Pressure in Inches of Mercury
ENG. & MIN. JOURNAL

Fig. 3. Diagram Showing Density of Dry Air in Pounds per Cubic Foot

The equivalent head is therefore $\frac{0.19}{12} \times \frac{62.33}{0.036} = 27.4$. (The factor 12 converts the difference in level into feet.)

The velocity in feet per second is $\sqrt{2 \times 32.16 \times 27.4} = 41.98$ ft. per sec. If the area of the flue is (say) 20 sq.ft., then the volume of gases is $20 \times 0.95 \times 60 \times 41.98 = 47{,}857$ cu.ft. per minute.

When much work of this nature is done, to facilitate the calculation, curves may be designed similar to the accompanying illustrations. In Fig. 3, the density w of the gas is found in pounds per cubic foot. For B it is true that we have three variables, but a half dozen of these curves may be plotted by assuming a given value for a cubic foot of water, then taking extreme values for w, varying, say, by 0.005 lb. per cu. ft. In most metallurgical flues, the factor w will remain reasonably constant, at least enough so that some one of the family of curves will give results close enough for control work.

In case the velocity head is very low, the reading may be magnified by some form of differential gage, as shown in Fig. 4. The slope should be accurately determined and the scale made in accordance, e.g., if the slope is 1 : 5, the scale should read 5 : 1. In such cases, the "manometer constant" should be low enough (i.e., the ratio of areas in the two legs) to compensate for considerable rise

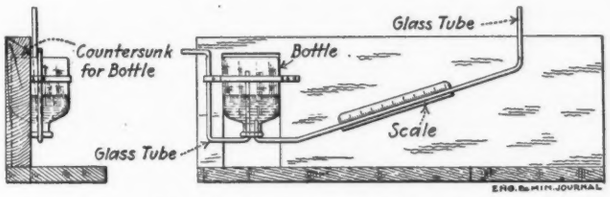

FIG. 4. DIFFERENTIAL GAGE

of liquid in the inclined tube. If the small tube is 1/8 in. in diameter and the large 2½ in., then for one linear inch change on the inclined scale, the liquid in the bottle will rise or fall $(1/8)^2 \div (2.5)^2 = 0.0025$ in., and the level in the large leg may be assumed to remain constant.

The results, to be dependable,must be carefully obtained. In regard to individual cases, much will depend on the accuracy and handiness of the engineer making the tests.

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El Oro Mining & Railway Co.

In a letter to the secretary of the El Oro Mining & Railway Co., Ltd., under date of Feb. 25, 1913, R. T. Bayliss, chairman, expresses an optimistic view of the prospects of the company. It was previously suggested that in order to permit time for complete development of the lower levels in the mine, production should be limited to about 20,000 tons per month and that 15,000 tons of tailing from the dump should be retreated at the same time. This recommendation has been adopted and carried out with notable benefit to conditions underground, the exposed orebodies being worked with greater economy, and time is allowed for the development of additional ones.

The Ofir claim has recently been added to the property of the company. This claim covers about 730 ft. of the strike of the West vein north of the El Oro boundary, and as this vein has been highly productive within the El Oro boundaries, it is believed that a substantial quantity of good ore will be developed in the Ofir claim. As the purchase was not completed until the end of November, 1912, development has not progressed greatly, but the 900-, 1000- and 1150-ft. levels are being advanced into the claim. Appearances to date confirm expectations and confidence is felt that further work will fully justify the purchase.

Discovery of additional important orebodies in the upper workings of the San Rafael vein are not expected; the most important development in this vein during the last year has been in drifts from the bottom of a winze below the 486-ft. level in the north part of the mine and from a similar winze in the southern portion. Substantial amounts of low-grade ore are expected to be developed here.

Work on the West vein during the year has been satisfactory and has exposed a large quantity of high-grade ore. A quantity of ore of good value was discovered on the 100-ft. level, and while it does not appear to continue upward, it will probably remain as productive on lower levels.

While no detailed statement of ore reserves is presented, it is believed that there is at this time sufficient ore developed to keep the mine running at its present capacity for two years at least. A great feeling of confidence in the immediate future of the property is expressed in the communication.

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Preliminary Survey for Mount Royal Tunnel

The Canadian Northern tunnel into Montreal under Mount Royal, has been previously mentioned in the JOURNAL, Mar. 1, 1913. In the *Canadian Engineer,* Feb. 27, J. L. Busfield describes the methods pursued in surveying for the tunnel, which is being run from both ends and also from an intermediate shaft. As the sides of Mount Royal seemed steep and inaccessible, traverses were first run around the sides of the mountain to locate the starting points.

For measurement, 100-ft., ¼-in. steel tapes were used, divided to hundredths and estimated to thousandths. All tapes were compared with one as a standard which was previously standardized by the Bureau of Standards for a pull of 12 lb., while supported at 20-ft intervals, at a temperature of 62° F. Between transit stations, measurements were made by means of spiders. These are low, three-legged standards carrying brass crosshair plates which can be considered as movable measurement points. Approximate measurement points were first set in line between the transit stations at about 99-ft. intervals and the spiders set up over these as closely as convenient. After measuring a course, the forward spider was left undisturbed to serve as the back point for the next course. At each measurement, different readings were taken by shifting the tape slightly until a series of five or six, checking within one thousandth or so was obtained. The tape was rested in hooks from standards at 20-ft. intervals and the tension of 12 lb. applied through cord wrapped over a bicycle wheel in an adjustable frame, a 12-lb. weight being suspended from the end of the cord. At the transit points, instead of using spiders, the line was carried up to the tape from the exact center by a transit at one side. The method required a party of 10 men. The spider points, as first set, were leveled over and the height of the spider measured in each case, so that the slope of the tape was known and the proper correction applied. On each of the supporting standards was a thermometer with its bulb near the tape so that the necessary temperature corrections could be made.

In reading the angles, a transit with a 7-in. plate was used, reading to 10 sec. It was set up by means of an auxiliary transit, to insure the vertical axis being exactly over the point. The targets on the sighted stations were also set up by transits. In reading, the angle was read once, and repeated up to six times, then read back to zero again to insure against slipping. The process was repeated by an independent observer. In one 5-mile circuit a closure of one second was obtained; in another of three miles, the error in angle closure was zero; and in none of the circuits was there an error of more than a few seconds. All the important traverses were duplicated by independent routes, giving a complete series of closed traverses, and from the base-line measurement an average degree of error was found to be about one in 40,000.

The measurements around the mountain being completed, it was necessary to project a line over the mountain in the same vertical plane as the tunnel center line. To do this the minimum number of transit points were selected and permanent concrete monuments built to hold the line. In setting up a transit at a monument, plumb bobs were discarded entirely and the transit was bucked into line until the cross hairs intersected both the far-away back sight and also the cross scratched on the monument close to it. The line was then projected to the monument ahead time after time, reversing the instrument between each sight. A mean was taken of all the points obtained at the foresight monument and the line thrown ahead from that point in the same way.

Levels were transferred in as accurate a way as possible with standard instruments; 18-in. wye levels were used with target rods. The level was set up three times for each turning point, these never being more than about 100 ft. from the instrument and equidistant therefrom. The whole operation was repeated four times with independent observers. The difference in their elevations of corresponding bench marks was only a few thousandths of a foot.

Calumet & Arizona Annual Report

The consolidated statement of the Calumet & Arizona Mining Co. and the Superior & Pittsburgh Copper Co. for the year ended Dec. 31, 1912 shows total earnings on copper, silver and gold of $9,083,988, which is increased by interest and miscellaneous earnings to $9,131,968; operating expenses deducted from this sum left a total of $4,540,883. There were produced during the year 53,108,628 lb. of refined copper, together with 594,319 oz. of silver and 22,881 oz. of gold. The value of the precious metal per ton of refined copper was $30.86 and the net cost of refined copper after deducting the value of the precious metals was 7.02c. per lb. During the year the Calumet & Arizona company paid dividends amounting to $2,452,781 and the Superior & Pittsburgh company paid $1,919,733, but of the income of the Calumet & Arizona $1,785,454 was dividends received, of which all or most was paid by the Superior & Pittsburgh.

The Calumet & Arizona company reports an extension of the time for final payment on the New Cornelia Copper Co. property at Ajo, Ariz., until Oct. 1, 1913, when $800,000 will be required. A favorable option has been taken on the Daggs-Newman group of claims near Superior, Ariz., which allows two years' development work without payment. Acquisition of the American-Saginaw holdings in the Bisbee district is recommended. During the year the Calumet & Arizona did over 25,000 ft. of drifting and raising and the Superior & Pittsburgh did about 29,500 ft. of sinking, drifting and raising. The Cortland mines of the Calumet & Arizona were reopened during the summer and shipments at the rate of 600 tons per week were continued from July 25 on. A total of 785 ft. of development was also done there. The Calumet & Arizona shipped 176,049 dry tons of ore to the smeltery in which the average percentage of copper was 5.077. The Superior & Pittsburgh shipped 288,845 dry tons to the smeltery with an average copper content of 6.361%. In August the Superior & Pittsburgh purchased the Wedge and Last Chance claims in the Bisbee district.

No important construction work was undertaken at the mining properties during the year except that in December the concreting of the Junction shaft was begun. The object of this is to eliminate the fire hazard which in the pumping shaft would be a grave danger.

The smeltery at Douglas is now handling 250 tons per day from the Shattuck-Arizona Copper Co., which will be increased to 500 tons when the new plant is completed. Work on the new plant is progressing satisfactorily and it is hoped that it will be in operation by Aug. 1, 1913, the time originally set.

New Building for U. S. Geological Survey Assured

Congress has recently authorized the expenditure of $2,596,000 for the construction of a modern fireproof building on ground already owned by the Government which shall accommodate, besides the U. S. Geological Survey, the Reclamation Service, the Indian Office and the Bureau of Mines, all bureaus of the Interior Department whose work is closely related to that of the Survey.

The public buildings law, which carries the Survey item, authorizes an immediate appropriation of $596,000, the balance to be appropriated as needed in construction. While this is only an "authorization" measure, leaving the actual appropriation of the money to a future act, $96,000 of the amount included in the measure can be expended immediately, having been appropriated by a former Congress in connection with the purchase of the site on which the Survey building is to be erected. Plans can thus go forward at once for the construction of the new building. For the needs of the Survey and the other bureaus mentioned an uptodate, conveniently arranged, and well lighted building is of special importance, since the present quarters are particularly lacking in the facilities necessary for efficient work.

Mica in 1912—Baker & Startin, of London, report that 1912 was marked by a continued increase in the demand for all grades of mica, and although supplies also increased, prices steadily advanced all round for block mica, due to some extent to an improved condition of trade and a marked revival of business in the United States. The development of new deposits of amber mica, constitute the chief mica mining feature of 1912, and these new arrivals of electrical mica have been well appreciated and also absorbed by the trade. Calcutta—A very marked rise occurred in the values, especially of the smaller grades, and stocks of unsold block are unusually low. Madras—Shipments have sold readily on arrival throughout the year. Prices lately are a shade easier, but the output is still far short of trade requirements. Sunday—East Africa and Mexico have furnished supplies of amber, mostly of medium quality, which, due to the inferior sorting and trimming, had to be realized at low rates. With improved grading we anticipate a good demand for this quality. Splittings—Increasing demand all through the year, with slight hardening of rates at close.

Electric vs. Compressed Air Hoists

By K. A. Pauly*

SYNOPSIS—In making comparisons, the working conditions must be understood, different equalizer systems being applicable to detached hoists and to groups. For safety, reliability, ease of control, and cost of operation, the electric hoist is claimed to be superior and its first cost is no higher. Rock-drill pressures impose uneconomical limits on air hoists. The flywheel equalizer always operates. Previous estimates for air systems checked in practice. Loading and dumping time and nonproductive work of great importance. Storage batteries in various combinations are satisfactory equalizers. The electric system is elastic in case of sinking. Load factor an important item in estimating steam consumption. Hecla electric-hoist performance analyzed. Hard-and-fast rules not possible; each case must be studied on its merits.

In the Journal for May, 18, 1912, Mr. Nordberg, under the title "Mine Hoisting Systems Compared," discussed a paper entitled "Electric Motors vs. Compressed Air Engines for Driving Deep Mine Hoists," presented by me at the Wilkes-Barre meeting of the American Institute of Mining Engineers, held in June, 1911. In this paper I compared the first costs and the costs of operating deep-mine hoists driven by compressed air and by electric motors, postulating two different sets of conditions: (1) for an isolated hoist; and (2) for a group of hoists served from one central plant, the term "isolated hoist" being applied to one which, because of its position with respect to the power station or other loads with which its fluctuating demands for power will interfere, or, which because of the penalization of the peak loads, if power is purchased, must be treated as the only hoist connected to the system. The important factors to be considered in such a comparison are: (1) safety; (2) reliability; (3) cost of operation; (4) first cost.

I showed that from the standpoints of safety, reliability and ease of control, the electric hoist has considerable advantage over its compressed-air competitor; that its first cost is practically the same as that of the compressed-air hoist; and, that its cost of operation is much lower, the difference being sufficient to practically pay for the complete installation in from five to six years. The conditions assumed are fairly general, and the conclusions drawn will be found to hold in most cases if those interested will look carefully into the merits of the two systems.

Two Systems of Electric Equalization Used

Although Mr. Nordberg has not refuted these claims, it would appear from his discussion that there were many points in my paper which were not clearly understood. The load of a mine hoist fluctuates between very wide limits and in America two of the many systems proposed for eliminating the peak demands in electric hoists have been used; the flywheel motor-generator system, and the flywheel-balancer system in which peaks in the combined load of several hoists are eliminated by a central equalizer. Mr. Nordberg, in several instances, compares the flywheel motor-generator system, which is applicable to isolated hoists, with hoisting with compressed air under the conditions existing in Butte, where a large group of hoists can be supplied from a central plant and to which the central equalizer system is best suited.

Rock Drill Pressures Inefficient for Hoists

In his discussion of the question of the practical limit to the pressure of a compressed-air hoisting system, he does not specifically state that, were it not for the fact that the pressure of the air-drill system at Butte was 90 lb., the pressure of the air for the hoisting engines might have been made considerably higher, but the natural inference from his statements is that this is the fact, and he has omitted entirely from consideration the question of economy brought out in my paper as one of the factors affecting the choice of pressure. If we ignore the question of efficiency, and, therefore, the cost of operation, the pressure for the hoists may be made anything within reasonable limits.

While unquestionably the flexibility resulting from connecting the hoist and the drill systems at Butte and elsewhere, is an important consideration in determining the pressure for the hoists, nevertheless, were there any considerable economy to be gained by the adoption of a higher pressure, this interconnection would not be warranted.

The pressure there is actually fixed by a compromise between two opposing factors: (1) the cost of the equipment, including compressors, engines and distributing systems; (2) efficiency. Within a considerable range, the higher the pressure, the lower the first cost of the equipment. But as the practical limit of temperature for reheating the air is approximately 400° F. for engines constructed as those at Butte, the question of economy imposes a practical limit to the pressure approximately corresponding to 90 lb. at sea level.

Intercooler Water and Compressor First Cost

Mr. Nordberg offsets the cost of water for the compressor intercoolers by the cost of water for the bearings of the flywheel set, if one is used. Frequently it is not necessary to use water for cooling the bearing, although usually provision for doing so is made as a precautionary measure. In those cases where it is necessary, the quantity of water required is much less than that required by the intercooler.

I have frequently found that in discussing the comparative first costs of the electric and compressed-air systems, no allowance is made for the first cost of the compressor, the intention being to utilize existing excess compressor capacity, but, as pointed out by me, this is seldom justified; for, if there is any considerable excess of capacity, it has been provided either for future growth or to take care of an emergency. If advantage is taken of this excess, the protection afforded by it is sacrificed, and the equivalent capacity should be added and charged against the compressed-air hoist.

*Engineer, General Electric Co., Schenectady, N. Y.

Flywheel Speed Variations Depend on Many Conditions

The most economical variation in speed of the flywheel motor-generator set depends upon a number of conditions, and can be determined only by a careful study of the following factors: friction and windage losses of the flywheel, which increase with the weight; the percentage of time the hoist is idle; the power consumed in the slip regulator controlling the flywheel, which increases with increased speed variation, and, therefore, with decreased weight of the flywheel; whether it is necesary to hoist unbalanced, and, if so, whether it can be done at reduced speeds.

If hoisting is done out of balance and it is necessary to maintain the same average demand on the power system, we must draw more energy from the flywheel than when hoisting in balance. This additional energy may be made available either by increasing the weight of the flywheel and thereby its friction losses, or by increasing the variation in speed and thereby slip regulator losses and the cost of the whole set, but usually it will be found more economical to design the flywheel for the minimum weight which will satisfactorily take care of the unbalanced condition with approximately 30% variation. It is hardly worth while to increase the reduction in speed beyond 30%, as, with this reduction we have drawn approximately 50% of the energy from the wheel and any further reduction increases the cost of the flywheel set at a greater rate than is warranted by the increased energy available. A flywheel designed on this basis will seldom have a speed variation of more than 15% and frequently not more than 10% when hoisting in balance, the normal operating condition.

Upkeep Greater for Compressed-air System

Mr. Nordberg states that the flywheel motor-generator requires attention and is subject to wear and tear, and that such is not the case with the air receivers. This is quite true, but it must be borne in mind that the flywheel alone in the electrical systems corresponds to the storage reservoir in the air system and, like it, is not subject to wear. In maintenance and repairs, the electric system, considered as a whole, has much the advantage of the compressed-air system. For, granting that the hoist motor will cost as much in this respect as the air engine, which is not the case, we have, to offset the flywheel motor-generator set of the electric hoist, the reheater, which resembles a surface condenser, a small high-pressure boiler supplying steam to it, and the motor-driven compressor; the combined maintenance and repairs of these will greatly exceed that of the flywheel motor-generator. Further, as stated, for a large camp like Butte, it is not necessary or desirable to use flywheel motor-generators with each hoist, a central equalizer plant being cheaper, more efficient and equally satisfactory. In fact, by the use of a central storage plant of comparatively small capacity, a practically uniform demand from the power system can be maintained.

Power Always Returned to Flywheel or Power System When Lowering Unbalanced

The statement that power cannot be automatically returned to the system with an electric hoist when lowering unbalanced unless the load is lowered immediately after an approximately equal load has been hoisted, is incorrect. Let us assume the most unfavorable condition: with the flywheel motor-generator set running at full speed, it is desired to lower a full load, unbalanced. In lowering, the work done is transmitted to the flywheel motor-generator set, which in turn speeds up, not dangerously, as indicated by Mr. Nordberg, but only 4 or 5%, the induction motor which drives the set then acting as a generator and delivering power to the general supply system. There are many electric hoists both in America and abroad operating unbalanced, in connection with which no flywheels are used, the power developed in lowering being entirely returned to the power system except for the losses in transmission. The underground hoist at the Calumet & Hecla mine may be cited as a good illustration of this point, this hoist operating entirely unbalanced, power being supplied to the hoist motor by an induction motor-driven set without a flywheel.

As stated by Mr. Nordberg, the compressed-air engine may be operated as a compressor, thereby acting as a brake, when lowering unbalanced and possibly theoretically when stopping the hoist at the end of a balanced trip, but, under practical, operating conditions, advantage is seldom, if ever, taken of this latter possibility, while with the electric hoist recommended, power is always returned in stopping, and no special provision need be made in the control to accomplish this.

Graphic Methods Satisfactory for Hoist Calculation

As to the method of calculating the work and power consumption of a mine hoist I wish to point out the well known fact that many problems, including the one in question, may be solved either analytically or graphically, and that while the graphic method frequently does not possess the accuracy of the analytic method, it is resorted to because of its greater simplicity, its accuracy being well within the required limits. I have always used the graphic method of determining the load diagrams of mine hoists and believe it to be universal practice. The accuracy of the methods employed is clearly shown by the following results:

In Fig. 2 of my paper previously mentioned, the powers consumed by the electric and air hoists are given for conditions quite similar to those at Butte. From these curves the efficiencies of the air and electric hoists may readily be calculated, bearing in mind that the power for shifting and other nonproductive work is included

RESULTS OF GRAPHIC CALCULATION OF HOIST EFFICIENCIES

Depth From Which Ore is Hoisted	Compressed Air Hoist Efficiency	Electric Hoist Efficiency
800 ft.	28.7%	33.2%
1200 ft.	29.9%	37.2%
1600 ft.	29.2%	38.9%
2000 ft.	27.7%	39.2%
2400 ft.	26.6%	38.7%

in the total power consumption, and that the temperature of the air at admission is assumed to be approximately 400° F., while at Butte, during the test with which comparison is to be made, no nonproductive work was done and the air was reheated to approximately 260° F. The efficiencies calculated from these curves when hoisting from the various levels, eliminating the nonproductive work and correcting for difference in reheating temperature, are given in the accompanying table.

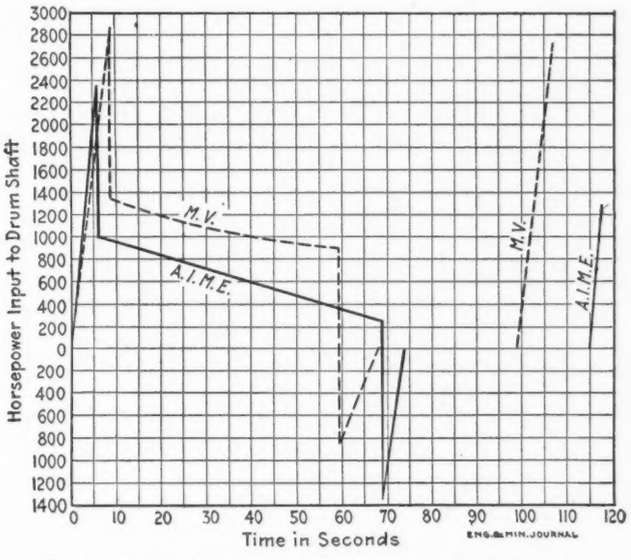
In the accompanying diagram are given the load curves corresponding to the conditions assumed in my paper

(Curve A. I. M. E.) and those corresponding to the conditions existing at the Mountain View mine at Butte (Curve M. V.). It is apparent from the similarity of these curves that the efficiency of the Mountain View hoist is practically the same as that of the assumed hoist. The test at the Mountain View mine was made on a large air-engine-driven hoist and the reported results correspond within a fraction of 1% with those predicted previously by me.

With reference to the effect of the frequency of hoisting upon the efficiency of the electric hoist, it will suffice to say that its power consumption, as given when hoisting from the various levels, is the total power and includes all losses in the hoist motor, in transforming and transmitting the power and in equalizing the load.

Costs Previously Given Too Favorable to Air Hoists

In estimating the cost of operating the air hoist, I charged it with one fireman per shift, for three shifts,



Efficiency Curves—Estimated and Obtained

on the reheater. Apparently Mr. Nordberg charges nothing for this work, justifying his position by the fact that at least one fireman per shift is usually required on the boilers for supplying steam to the change houses. While, perhaps, more accurate accounting would apportion this fireman's expense between the change houses and the reheater, I am inclined to yield the point to Mr. Nordberg. However, this slight disadvantage to which the air system was put, is much more than offset by other charges which were made too favorable to it. These consist in the fact that the efficiency of reheating, as found by actual experience at Butte, is only about half of that assumed in estimating the cost of fuel consumed by the reheater; and that the cost of power for the air system should be greater than that given, its actual efficiency being considerably lower than assumed, as the air is reheated to a lower temperature in practice than that assumed in my estimates.

By deducting from the operating costs of the air hoists, the amount charged to labor for reheating and by increasing the fuel and power items to make them correspond with the efficiencies obtained at Butte, the cost of operating the single air hoist is increased over the figures given in Table II of the original paper by approximately $5000, and the total saving with the electric hoist over the air hoist is increased from $10,500 to approximately $16,000. This also applies to the comparison between the operating costs of the electric and the air hoists for a group of hoists, as given in Table IV, of the same paper.

Previous Calculations of Air Capacity Proved Correct in Butte

In regard to the compressor capacity required for the air system, reference to my paper will show that for a group of hoists under conditions similar to those at Butte, the required compressor capacity is 36,000 cu.ft. of free air per min. for an output of 12,000 tons per day from a depth of approximately 2000 ft. (1.5 cu.ft. capacity per 1000 ton-ft.) which checks closely with the capacity provided at Butte, namely: 30,000 to 40,000 cu.ft. for handling approximately 15,000 tons from an average depth of probably less than 1500 ft. (1.33 to 1.78 cu.ft. capacity per 1000 ton-ft.). Furthermore, I understand that special arrangements have been made with the mining company at Butte to distribute its hoisting more uniformly throughout the day than was the practice with the steam hoists, in order to keep down the compressor or storage capacity.

Loading and Dumping Time Must Be Considered

Apparently, Mr. Nordberg has not correctly interpreted the conditions used by me as the basis of comparison for the two systems of hoisting and the conclusions which he draws are, therefore, incorrect. He makes no allowance for the normal time required for loading and dumping, which must be considered quite as much a part of the hoisting cycle as the accelerating, full-speed, and retardation periods, since it is during this period largely that the flywheel of the flywheel motor-generator set is being brought back to full speed. In my estimate of 40% as the time required for hoisting ore, I included 40 sec. per trip for loading and unloading, from which it follows that, on Mr. Nordberg's basis of estimating the time consumed in hoisting, the 40% is reduced to 25% from the 2000-ft. level and to 15.5% from the 700-ft. level, which is not very different from Mr. Nordberg's estimate of 20%, when hoisting normally from several levels.

The nonproductive work which a mine is called upon to perform, varies between very wide limits for different mines and the figures I assumed, namely, 50% of the power consumed in hoisting ore, represent a fair average. In a later report covering the conditions at Butte, I assumed the nonproductive work as 75% of the productive, which checks closely with Mr. Nordberg's estimate of 87%. However, the use of 50% is favorable to the air system, the increase calling for a greater increase in power consumption for the air hoist than for the electric, due to its lower efficiency.

From an operating standpoint independent of the question of economy, the air system as installed at Butte has been thus far entirely satisfactory and as compared with the old steam equipments these hoists are unquestionably more economical. However, as stated by me, a system of electric hoisting would accomplish all these results and might have been installed for a first cost equal or less while netting a considerable saving in annual cost of operation over the air hoists.

Electric Peak Loads Eliminated When Necessary

As to peak loads, provision is made, in the system proposed by me, for eliminating the peaks of the electric hoists as completely as they are eliminated with the air hoists; and, as a matter of fact, the maximum demand for power with the electric hoists would be considerably less because of the higher efficiency of the electric system. It is interesting to note, however, in this connection, that this same mining company is electrifying its steam road between Butte and Anaconda, power being obtained from the same source as for the mines, and that while the power demands will fluctuate between the wide limits common to railway loads, yet no provision has been made for eliminating the peaks.

No definite statement can be made as to the most advantageous conditions under which electric hoists can be applied, as so many variable factors are involved in this question. However, one great advantage which the electric hoist possesses over all its competitors is, that through its use, power for hoisting may be generated in a central plant favorably located for the economic development of power.

We are not concerned in the type of prime mover used at the central station, whether waterwheel, gas engine, oil engine, reciprocating steam engine, or turbine. The points which concern us, so far as production of electric power is concerned, are the reliability of supply and the cost at the mines, and, depending upon local conditions, any one of the several types of prime movers may be preferable.

Storage Batteries Wrongly Applied

Mr. Nordberg has referred to the replacement of storage batteries, used with European mine hoists, by flywheels for equalizing the hoist loads. It would appear that he does not appreciate the difference in conditions under which these batteries operated and those imposed upon the batteries operating under conditions outlined in my paper. These early European installations which use the storage battery were isolated hoists, and it was for these that I recommended the use of the flywheel motor-generator set. Where a group of hoists is served from a single central station and the fluctuations in the combined loads of the several hoists are such as to interfere with the regulations of the system, a storage battery, alone or in conjunction with flywheels, is an efficient and reliable means of eliminating the peaks. The combined load of a group of hoists resembles that of several cars in an electric-railway system. The success met with by using storage batteries to provide for the fluctuations in loads of railway systems is undisputed. More severe from the standpoint of fluctuations than the combined load of either a group of hoists or a railway system, is the combined load of a rolling mill in which the main rolls are driven electrically. Storage batteries are being successfully used for eliminating the peaks in such mills.

With conditions similar to those at Butte a storage battery or a combination of storage battery and flywheel can be used, in which case the flywheel serves to eliminate the peaks of short duration and the storage battery the peaks of longer duration, energy being retained in the battery during long idle periods.

Electric hoists in Europe, Mr. Nordberg states, are operating under conditions extremely favorable to load equalization by flywheels, hoisting always being done in static balance and from one level only and that the hoists there are equipped with Koepe sheaves and tailropes instead of drums. Whether or not this is true, it is beside the question, as, in Africa, where the electric hoists greatly exceed in capacity those in Europe, the Koepe disk and tail-rope are seldom, if ever, used; the electric equipments are all of sufficient capacity to operate the hoists unbalanced and they are frequently called upon so to operate. They are all capable of performing any work which can be accomplished by air engines and probably more.

Details of Electric Hoist Design Depend on Conditions Imposed

Regarding the details in design of the flywheel motor-generator, i.e., the weight and speed of the flywheel and the type of bearings, whether self-cooled or water-cooled, or whether supplied with forced lubrication, etc., it suffices simply to state that each hoist must be considered on its own merits, the equipment designed to meet the conditions imposed and the efficiency determined from a consideration of all the losses which take place during both the running and the idle periods. In my paper the power consumptions of the hoists have been estimated on this basis. Thus compared with the air or steam hoist, the electric hoist will be found superior to either in almost all cases. All that the advocates of the electric hoist ask is a careful and unbiased analysis of the relative merits of the several systems.

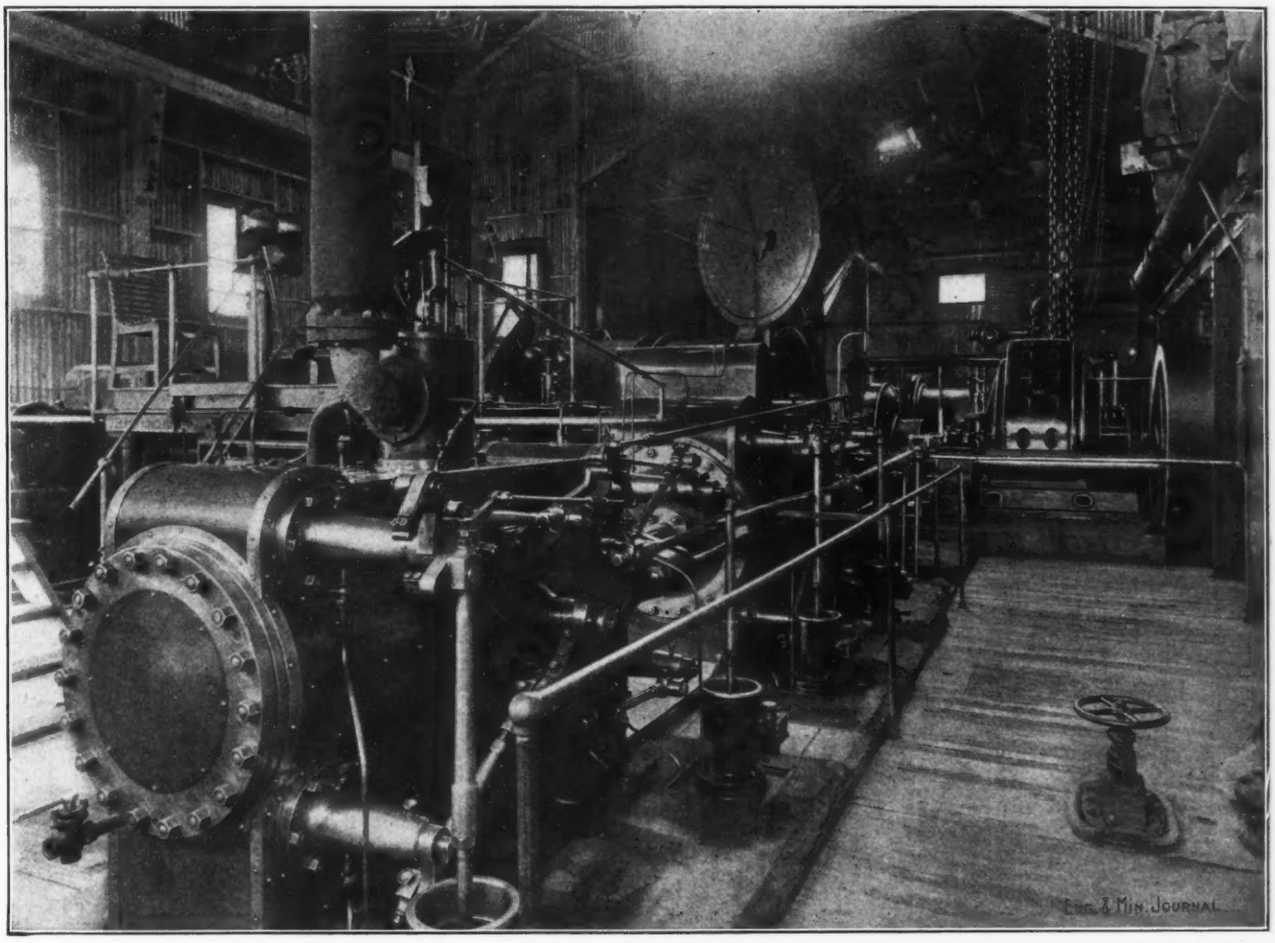
Referring to the flywheel speeds, 16,000 to 21,000 ft. per min., it will be of interest to those unacquainted with the subject to learn that the turbine wheels of modern steam turbines run at speeds as high as 42,000 ft. per min. and with diameters considerably less than those of the flywheels mentioned. Furthermore, the forced lubrication and water cooling of bearings have long been standard practice and the ruggedness and reliability of the hoisting systems using the flywheel is best shown by the fact that the first equipment installed in the United States some six years ago has operated continuously since without any interruption.

The inference naturally drawn from the first two paragraphs of the second part of Mr. Nordberg's article is that the steam or air hoist possesses considerable advantage over the electric in mines where the depth of the shaft is constantly increasing, although he does not definitely state this. The fact is that no matter whether the hoist is driven by a steam engine, an air engine, or an electric motor, it must be itself of sufficient capacity to operate under the most severe conditions; although, if at first it is not called upon to meet these conditions, the source of power, whether boiler plant, compressor plant, or electric plant, may be made small to start with and added to as the increased demands of the hoist make it necessary. The electric hoist, however, has the advantage where power is purchased. since if for any reason the power required increases, no additional installation expense on the part of the mining company is involved in meeting this demand.

The electric hoist lends itself to increased load and speed for maintaining constant tonnage as the depth increases. In second-motion hoists, which are coming much more into favor because of the introduction of the higher efficiency, noiseless gears of the cut herring-bone type, the

drums may be designed for maximum requirements and equipped with a motor sufficient for the demands at first, a second motor being added when the depth of the shaft has increased sufficiently, or when it is desired to increase the rope speed or load.

While first-motion hoists are not so flexible in this respect, the same flexibility can be obtained where it is desired to increase the load, as the depth of the shaft increases, in order to maintain the same tonnage; but, where the tonnage is maintained constant by increasing the speed, as the depth of the shaft increases, the initial motor must be of sufficient capacity to drive the hoist under maximum conditions. Neither the steam engine nor the compressed-air engine possesses this flexibility and



Induction Motor of 900 Hp., 2000 Volts, Replacing Steam Engine on Hoist of Rose Deep Mine, South Africa

if it is desired to maintain the tonnage as the depth increases either by increasing the speed or increasing the load, the engine must be designed to meet the maximum condition, or if not, replaced by new engines.

Coal Consumption Dependent on Load Factor

I am not in a position to comment on the steam consumption of the Copper Queen hoisting engines, but I have assisted in the testing of several modern hoists operating from depths varying from 600 ft. to several thousand feet and the minimum steam consumption which has been obtained is approximately 47 lb. per shaft hp.-hr., hoisting from approximately 2000 ft., this being obtained on an engine previously thoroughly overhauled and giving indicator cards of far better shape than those usually obtained from hoisting engines. The results of the other tests indicate that steam consumptions ranging from 50 to 80 lb. per shaft hp.-hr. are usually obtained under normal operating conditions. However, the relative efficiency of steam and electric hoists cannot be expressed in terms of steam consumption per shaft horsepower-hour, as is frequently attempted, nor is it correct to estimate the operating cost of hoisting at one mine from the costs of producing steam at another, even though the fixed charges on the boiler plant, the cost and quality of the coal, and the prices of labor are the same, unless the load factors of the two boiler plants are practically identical. Tests show conclusively that the efficiency of a boiler plant drops off very rapidly and the fuel consumption increases as the load factor, that is, the average demand as compared with the maximum, decreases. At one mine where the hoist was practically the only load on the boiler plant, a seven-day test showed that the fuel consumed during the idle period was approximately 50% of the total consumed in generating steam. For this reason the fuel saving with the electric hoist over other types is greater than that corresponding to their respective steam consumptions per shaft horsepower-hour, consumption for the electric hoist being taken as that at the central

plant required to produce one shaft horsepower-hour at the hoist. This results from the high boiler efficiency, due to the higher load factor of the central station supplying all the power for several mines, as compared with the load factor of the boiler plant of a single or comparatively small number of mines. Similarly the boiler efficiency is higher and the fuel consumption per pound of steam less for an isolated electric plant supplying a single mine, using a flywheel motor-generator set.

Electric Hoists Replacing Steam and Air Hoists in South Africa

The complete discussion of the relative economy of steam and electric hoists can hardly be covered in a paper of this kind, and it will not be attempted. However, the proof of the pudding is in the eating and in Europe and South Africa, where elaborate tests have been made, and especially in South Africa, where the steam engine, air engine and electric motor have been thoroughly tried out, the electric hoist has been almost universally adopted for new installations, and often for replacing practically new high-grade steam equipments. Mr. Nordberg in an effort to make a favorable showing for the steam hoist has used the reported steam consumption of the Copper Queen engine and the apparently incorrectly figured steam costs obtained at the Butte boiler plants, as against one cent per kilowatt-hour for the cost of electric power, although its cost at Butte is much less. He has further loaded the cost of operating the electric hoist by a charge of $200 for an electrician. An electrically operated mine or group of mines would have an electrical engineer in charge, whose salary would be determined by the magnitude of his duties, and a proper charge for his services made against the hoists, as should be made against the steam hoists for a steam engineer, but to charge $200 per month against the electric hoist for an electrician is absurd. As regards the cost of steam at Butte, Mr. Nordberg gives $0.38½ as the cost of producing 1000 lb. of steam, this figure being based on $90 per boiler horsepower per year. If this cost is based on boiler horsepower installed, as it would appear to be, it cannot be used as a basis for determining the cost of steam, inasmuch as the steam generated probably varies widely from that corresponding to the installed boiler horsepower.

Efficiency of 41% for Hecla Electric Hoist

The operating conditions of the electric hoist installed by the Hecla Mining Co. at their mine at Wallace, Idaho, are described by Mr. Nordberg and he obtains a figure of 17%, which he gives as its efficiency. A brief analysis of his calculations will make apparent the absurdity of this result. In the paragraph directly under Table III, Mr. Nordberg points out that the nonproductive work at this mine exceeds the productive and states that during February, 1911, the power consumed in doing nonproductive hoisting was equal to 1.86 times the energy required for the productive work. Now, going back to the first column on page 1037, we find an estimate of the productive work as 9,821,000 ft.-tons per month. In the next paragraph the nonproductive work is given as equivalent to hoisting 999 loads, of 1.1 tons each, over a distance of 300 ft., which gives 330,000 ft.-tons as the nonproductive work per month, or 10,151,000 ft.-tons as the total work done by the hoist per month. From this and the total amount of electric power consumed, 17% is deduced as the efficiency of the hoist. But in these figures the nonproductive element is given as only 3.4% of the productive, instead of being 186%, 1.86 times as great, which was given as the figure determined by actual test. A figure for the nonproductive work 1.86 times the productive, would give results for productive work of 9,821,000 ft.-tons and for nonproductive work of 18,086,000 ft.-tons or a total of 29,085,000 ft.-tons, resulting in an efficiency of 48.7%. But, as the nonproductive work is usually done at lower efficiency than the productive, it will probably be more nearly correct to assume the actual nonproductive work as 1.5 times as great. Based on this assumption, the total work will be 24,552,000 ft.-tons, corresponding to an efficiency of 41%, which is not so high as can be obtained under more favorable conditions, but is considerably higher than can be obtained by air under the conditions existing for this hoist, and, I think I am safe in saying, higher than that obtainable with any practical system of air hoisting.

Hard-and-Fast Rules Not Possible

In conclusion, Mr. Nordberg has given some hard-and-fast rules which are apparently intended to serve as a basis for choosing a type of hoist to meet the wide variety of mining conditions, although earlier in the paper he has very correctly stated that to do this is impossible. Just how electric power generated by gas engines operating on blast-furance gas is especially adapted for driving mine hoists is a question on which one would like further light. He states that for deep mines with irregular hoisting conditions, with rapid hoisting during short intervals, with long pauses, handling unbalanced loads and lowering material and men out of balance, the electric hoist is at a great disadvantage, but in what respect, he does not state. It is gratifying, however, to note that he frankly admits the modern electric hoist to be a perfect mechanism and as such, leaving nothing more to be desired, although he claims that even under the best working conditions it is wasteful and inefficient.

I wish to repeat, that the choice of a type of hoist is dependent upon a wide variety of conditions which vary greatly even among mines situated in the same camp and that a choice can only be made after a careful study of all the conditions affecting the problem in question. If completely analyzed on its merits, the electric hoist will be found to possess advantages over all its competitors, even in those cases in which the operating conditions are favorable to the other types.

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Electrokali

A new potash fertilizer is proposed by the Swedish metallurgist Axel Lindblad (*Journ. du Four Electrique*, Jan. 15, 1913). It is made by fusing feldspar, or other potassium silicate, with carbon and iron, producing ferrosilicon and a scoria containing the potash in readily soluble form. The fertilizer is expected to show an advantage over Stassfurt salts in not introducing any chlorine into the fields. It will be sold under the name of electrokali.

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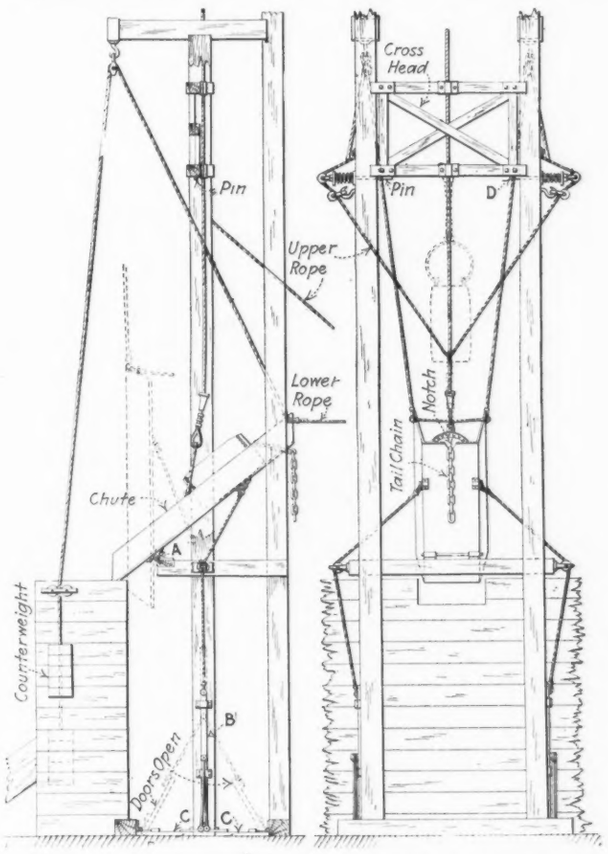
The Lobsann Mining Concession, covers an area of about 5000 acres, near Lobsann, in Alsace-Lorraine, and has been worked with success for asphalt for the last sixty years. According to U. S. Consul Milo A. Jewett ("Daily Consular and Trade Reports," Feb. 28, 1913) the deposit occurs at considerable depth in the form of bituminous rock seven to 14 ft. thick. It is controlled by the Lobsann Asphalt Co. of Amsterdam.

DETAILS OF PRACTICAL MINING

Devices for Bucket Dumping

By J. R. McFarland

An ingenious dumping arrangement is employed at a Nevada mine. Hoisting is conducted with a bucket, and it is customary to keep the collar of the shaft closed with hinged doors, except when the bucket is passing through. To manipulate these doors and dump the bucket, either necessitated the employ of an extra man at the shaft, or made a large amount of additional work



Arrangement for Dumping Bucket from Hoist

for the hoistman in running back and forth between the hoist and the shaft. Four round trips were required on his part for each hoisting trip, as follows: To shaft to open doors, to engine to raise bucket, to shaft to insert dumping hook, to engine to dump, to shaft to detach hook, to engine to lower bucket, to shaft to close doors, to engine to await next trip. This extra work was eliminated by the use of the devices herewith illustrated.

On receiving the signal to hoist, the engineer releases the lower rope. This allows the counterweights to pull the chute up and away from the shaft, the chute being pivoted at *A*. The chute pulls with it the sliding rods *B*, just above the collar, which by means of connecting arms opens the doors *C*. The bucket is then hoisted until the crosshead passes above the pins set in the guides at *D*. The upper rope is next pulled by the engineer, throwing in the pins against the force of the springs shown in the drawing. The bucket is lowered until the crosshead rests on the pins and holds them in position. The lower rope is pulled, bringing the chute into position under the bucket and closing the doors. The chute, in swinging over, catches the tail chain of the bucket in a notch in its upper end. The bucket is lowered and is dumped as shown, the tail chain preventing it from sliding in the chute without dumping. The bucket is hoisted, and as soon as the crosshead is lifted from the pins, the springs force them back. The lower rope is released again, swinging the chute out of the way and opening the doors. The bucket and crosshead are lowered and the doors closed. Different arrangements of the counterweights from that shown can, of course, be used.

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Relation of Mechanical and Physical Properties of Timber

Certain physical properties of timber are significant in judging its mechanical properties, it is stated in *Bull.* 108 of the U. S. Forest Service. The points which can be observed are: colors of wood, proportion of heartwood to sapwood, position of pith in cross-section, rate of growth, weight and proportion of summer-wood. The color of the wood is usually determined by whether the piece is sapwood or heartwood. This coloration has no effect on the timber's strength nor has that due to certain fungi. But marked color variation may indicate incipient decay.

The ratio of heartwood to sapwood does not bear any relation to breaking strength, but sapwood is invariably less durable than heartwood and should be avoided unless the timbers are to be treated.

The position of the pith in the section of the timber does not bear any apparent relation to the timber's strength, but checks usually extend from the surface toward the pith and when the latter is near the neutral plane there is a greater tendency to form checks there and thus give opportunity for splitting or horizontal shear. The rate of growth is determined by counting the annual rings in a section. For most species there is a rate of growth which in general is associated with the greatest strength, but the results are rather conflicting and it is safe to conclude that the number of rings per inch is no index of the mechanical properties of different varieties of timbers especially those containing knots and defects.

As regards the dry weight, other things being equal, the heavier the timber the greater is its strength. Summer-wood is the dark, relatively dense portion of each annual ring, the light more porous parts being termed spring-wood. The summer-wood is a desirable element in the timber, and is an important guide in judging timber quality.

Substitutes for Steam Thawing in the Yukon

It is common practice in the Yukon district, for the purposes of thawing the overburden, to use steam points driven in at intervals varying from eight to 10 ft.. In a paper delivered before the Ottawa meeting of the Canadian Mining Institute, Henry Mace Payne states that the common method of spacing is in 8-ft. rectangles or 9½-ft. triangles. The thawed ground may be considered as consisting of cylinders surrounding the thawing points as centers. Thawing is continued for 72 hr., followed by a sweating period of 24 hr., giving a total of 96 hr. for the process.

Experiments were conducted with hot water as a substitute for steam, using approximately the same apparatus. It was found that the distance between thawing points could be materially increased using hot water, and an acceleration of the thawing process obtained, as the diameter of the cylinder to be thawed was increased. After preliminary tests it was decided to start the points twice the regular distance apart, and operate them four times as long, having four times the volume of material to thaw, or 16 days for each 16-ft. cylinder, but it was found in practice that 11½ days sufficed to thaw the material as well as it was thawed under the former method, and if this was followed by 2½ days sweating, two days would be saved on the operation, with a corresponding direct saving in fuel cost. In addition to this fuel economy there was a direct labor saving of 75%, in driving and pulling points, which amounted in the case of the company in question to over $135,000 in the operating season of 150 days. The quantity of water required, however, is 3.6 times as much as for steam of the same pressure. The boilers were supplied by injectors or pumps and the pipeline directly connected with a discharge at the lower part of the boiler.

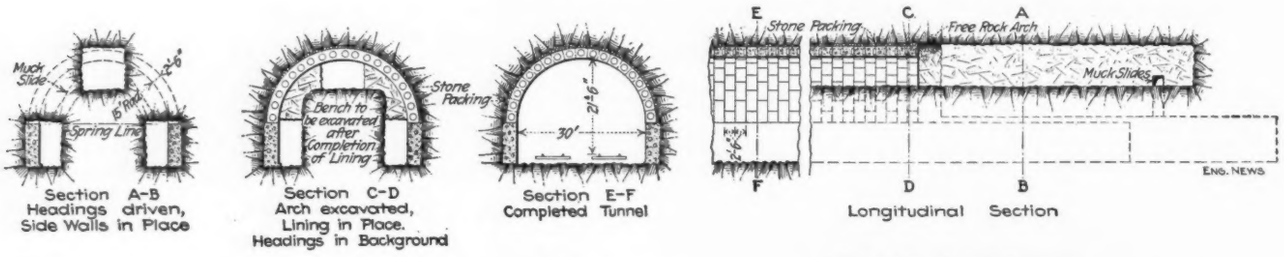
Another possible alternative contemplates the use of electricity in a similar manner. Inasmuch as a large quantity of available water power is present in the district, electricity as a source of heat would not be incomparable with either efficiency or economy. Its use would necessitate the construction of a strong heating point which could be driven into the ground.

Natural or climatic thawing is also employed at present in the district to some extent, its success depending largely on the ability to remove rapidly the thawed material which would otherwise insulate the frozen ground below. For this purpose sluicing is sometimes resorted to.

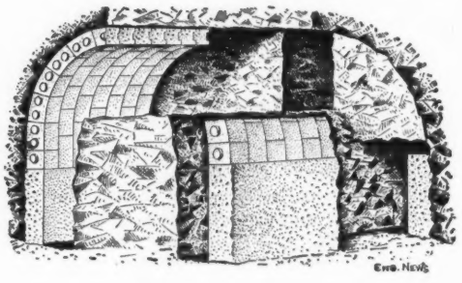
Proposed Method of Driving and Lining Large Tunnels

The accompanying drawings show a new method, proposed by John F. O'Rourke, of the O'Rourke Engineering Construction Co., for driving and lining a loose-rock tunnel, which avoids the necessity of timbering. The method (*Eng. News,* Feb. 13, 1913), depends on the use of the O'Rourke interlocking concrete blocks, the shape of which is such that they can be set in place and built into an arch without centering. Thus they make it possible to keep the lining built in a fully supporting condition close up behind the working face. The additional excavation necessary for placing the timbering outside the lining, which in the case of full timbering amounts to 15% or more, is also avoided.

Two side headings are driven at the bottom of the tunnel, and a center heading along the top. The bottom headings are carried along in advance and the side walls are built up to the spring line. At intervals openings are made for the disposal of excavated material from the top heading through the bottom. The rock between center and side headings along the roof, is broken down, the rings of lining blocks are erected, and the packing put in, so that the ring carries its part of the roof. The unsupported roof can always be kept so short as to be stable without timbering. The central core of the tunnel excavation is left in place until the lining is completed, affording a firm support during the difficult part of the operation, and is removed later under the most favorable conditions.



METHOD OF TUNNELING IN HEAVY GROUND WITHOUT TIMBERING, USING INTERLOCKING CONCRETE BLOCKS



As top-heading muck is removed through the bottom heading, a way is open for bringing in material and carrying a traveler to erect the lining, free from interference. An upward-projecting metal screen carried at the front of the traveler will protect the forward face of the concrete-block lining from any injury by the blasts required in removing the wedge of material between top and side headings.

The principal feature of the O'Rourke concrete blocks, was described in *Engineering News,* Nov. 28, 1912, p. 1022. Each block has two or more projections on one side face with corresponding recesses in the opposite face, so spaced that the blocks in successive rings break joints and

thus lock the rings together securely, the projections and recesses furthermore, being of such length and depth as to leave an open joint space between faces of the blocks. The outer edges of all the joints are provided with moldings to reduce the size of the joints there and serve to retain a waterproofing preparation for preventing the entrance of water or other material from the outside. The blocks are placed without mortar at the time of setting, and the longitudinal joints are wedged so as to be capable of transmitting arch thrust even before the joints are filled. The subsequent joint filling may be done by any one of many different methods.

The manufacture of the blocks in advance at a plant outside of the tunnel gives greater economy than is possible when concrete is mixed and placed in forms inside the tunnel, and a perfect concrete is insured by reason of the ease with which the individual blocks may be inspected and tested. Incidentally, all possible troubles from shrinkage of the concrete in drying are avoided, since the shrinkage of the individual blocks has already taken place before they are set in the tunnel.

It may be interesting to state that tunnel timbering cost approximately $100 per M. ft. b.m. in one case. In proposing very recently to build some rock tunnels, the bids for the tunnels timbered and lined in the usual way were higher by $65 per linear foot than for the same tunels built without timbering by the help of the concrete-block lining as described.

Electric Haulage Accidents

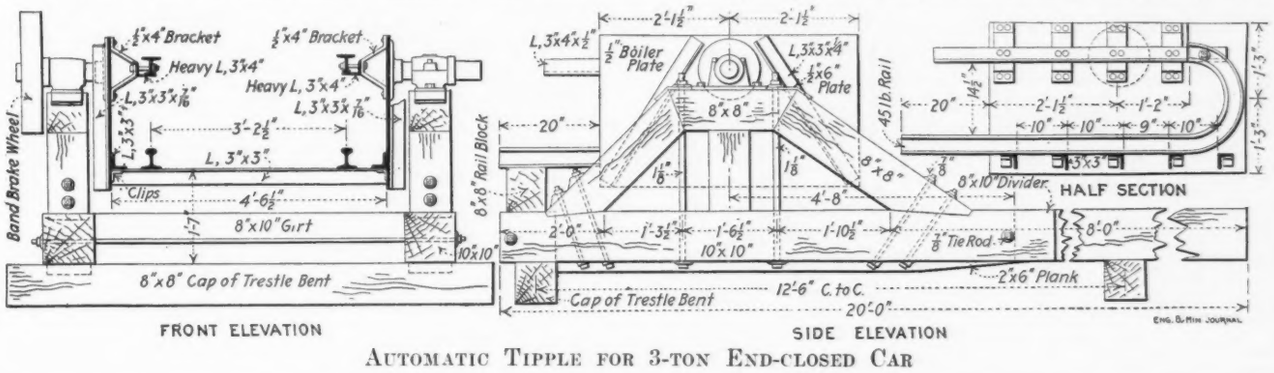
The introduction of electric haulage underground is responsible for three classes of accidents usually not otherwise present in mines. The first and most obvious is the risk of contact with the trolley wires. This can be partially overcome by the strict enforcement of rules covering the carrying of tools and general precautions, by protection of the wires with troughs and by the use of a voltage as low as practicable. The second class is the danger of being run down in narrow haulage-ways by the comparatively high-speed electric trains. If it is necessary for men on foot to traverse the same workings with the trains, sufficient room should be provided at one side to permit the passage of a train without touching a man, and, if possible, this should be a separate footway for the entire length of the working.

A third prolific source of minor accidents is stated by *Coal Age,* Feb. 15, 1913, to be the use of the outside-wheel locomotive, either electric or gasoline, where connecting-rods are not employed. On these machines the brake mechanism between the drivers forms a possible foothold for the trip brakeman. In attempting to step aboard the moving motor, should this man's foot slip, it is almost certain to be caught and crushed by the rear wheel. Many of the crippled and one-footed men to be seen about collieries can trace their misfortune to this cause. It appears to be utterly useless for the management of any mine to forbid men from getting aboard the locomotives in this way. So long as the opportunity is there, and the man wishes to get upon the machine, the temptation to do so from the side is well-nigh irresistible.

So numerous have been the accidents from this cause that some companies refuse to buy any new locomotives of this type, while the machines which they already possess having outside wheels have been guarded by an auxiliary plate or sheet of steel, hinged at the top of the motor frame and secured at the bottom by two or three bolts. This plate completely incloses both driving wheels and brake mechanism and presents no projections whatever that can possibly serve as a foothold.

Tipple for End-closed Car

The complete turnover tipple, shown in the accompanying drawings, was designed to unload end-closed cars of 3-ton capacity at the magnetite mines at Mineville, N. Y.



AUTOMATIC TIPPLE FOR 3-TON END-CLOSED CAR

The position of the tipple axles depends upon the style of car to be dumped. The train of cars is uncoupled some distance from the tipple and dropped by gravity to the tipple, where they turn through an angle of almost 180° to dump. The cars are righted by applying pressure to the hand brake, until the projecting rails rest on the 8x8-in. rail block. The cars after dumping are started from the tipple by hand and the grade from the tipple takes the cars to the "empty" spur by gravity.

Lubrication of Air Compressors

In the proper lubrication of the air cylinder of a compressor, probably the most important fact to bear in mind is that the oil should be used sparingly. Some operating engineers take it for granted that an air cylinder requires just as much oil as a steam cylinder and, accordingly, apply as large a quantity in the one as in the other. This assumption and procedure, however, are entirely wrong. An excess of lubricant, says *Power,* means not only a waste of that amount of oil, but also results in more rapid accumulation of combustible matter on the interior surfaces of the cylinder heads as well as on the valves and increases the tendency for the dust drawn in through the suction to adhere to the interior parts. In

ordinary air-compressor practice and for common-size cylinders, it has been found that from one to three drops of oil every five minutes will sufficiently lubricate the air end. It is also a good rule always to close the lubricators immediately before the compressor is shut down.

Next in importance to proper care and attention in the lubrication of air compressors is the selection of the best suited oil. To make this selection is not always easy, as it frequently involves rather exhaustive experiments and tests and also depends largely on the amount of compression, design of compressor, etc. Careful tests of various kinds of oils should first be made to determine the flash point, viscosity and so on. In general, nothing but a high-grade mineral oil having a flash point, say above 525° F., should be used and an oil should be selected which will leave little or no carbon deposit after it is volatilized. The reasons for this are obvious. When oils are used which volatilize readily, or have a low flash point, the gases, generated by the heat of compression, pass into the discharge pipe and receivers and do not require a high temperature to ignite. If the oil is of a coking nature it carbonizes on the air heads and valves and prevents the latter from operating properly, often resulting in some form of accident.

The explosions that sometimes occur in air compressors are caused mainly by the ignition of combustible matter deposited on the walls of the discharge pipe and in the valve ports. As all oils contain more or less of this matter, the interior parts of the machine should be carefully inspected at certain intervals, the frequency of which will depend to some extent upon the character of the oil used. Any deposit that may have accumulated as a result of the use of oil which has been acted upon by the high temperature of the air should be carefully removed. For this purpose ordinary soap suds may be fed into the cylinder through the regular oil cup. This application should be continued for several hours, the length of time depending upon the quantity of deposit existing. Care should be taken, however, not to let the machine lie idle with soap suds remaining in it; otherwise the parts effected will tend to rust. To avoid this possibility it is advisable to stop the feeding of soap suds and commence feeding oil a short time before shutting down the compressor.

The receiver and pipes into which the compressor discharges should be blown out regularly to remove any oil and water that might have accumulated, and especially should the discharge valves be inspected and cleaned at regular intervals, because if they stick they are likely to admit hot compressed air from the receiver back into the cylinder, thereby increasing the temperature of the air to such a high point before compression that it will reach the flash point of the oil during compression. It might also be added that the intake pipes should be so arranged that the free air is drawn in from the outside rather than from the engine room. This is important, because cold air gives a higher volumetric efficiency to the compressor, which means economy of power. Besides, it is also an effective way of decreasing the likelihood of explosions.

Underground Trolley Wire Protection

In recent numbers of the JOURNAL, there have been described various methods of constructing protecting troughs for underground trolley wires. V. V. Carr, in *Coal Age*, describes another method of protection, as shown in the accompanying illustration.

An iron strap is held by each trolley hanger, and boards

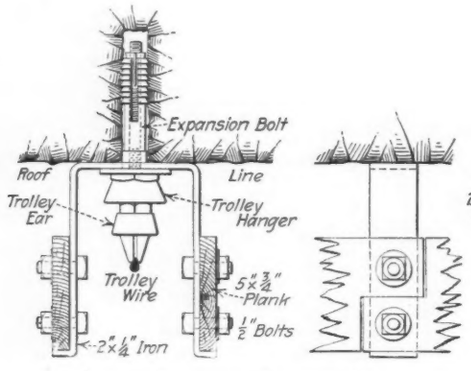


FIG. 1. DOUBLE HANGER SUSPENDED FROM ROOF

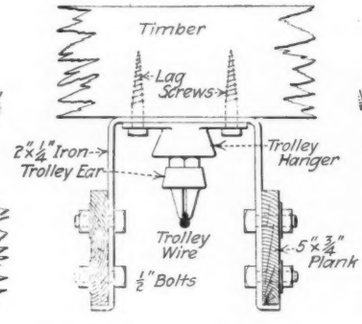


FIG. 2. DOUBLE HANGER SUSPENDED FROM TIMBERS

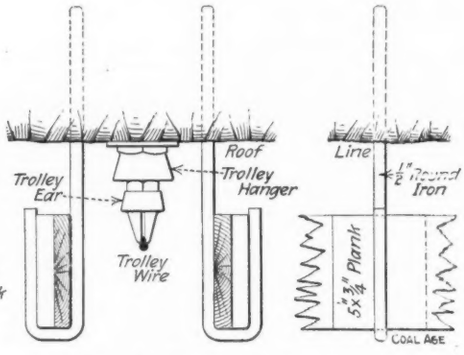


FIG. 3. SINGLE INDEPENDENT HANGERS DRIVEN INTO ROOF

and prevents the latter from operating properly, often resulting in some form of accident.

The explosions that sometimes occur in air compressors are caused mainly by the ignition of combustible matter deposited on the walls of the discharge pipe and in the valve ports. As all oils contain more or less of this matter, the interior parts of the machine should be carefully inspected at certain intervals, the frequency of which will depend to some extent upon the character of the oil used. Any deposit that may have accumulated as a result of the use of oil which has been acted upon by the high temperature of the air should be carefully removed. For this purpose ordinary soap suds may be fed into the cylinder through the regular oil cup. This application should be continued for several hours, the length of time depending upon the quantity of deposit existing. Care should be taken, however, not to let the machine lie idle with soap suds remaining in it; otherwise the parts effected will tend to rust. To avoid this possibility it is advisable to stop the feeding of soap suds and commence feeding oil a short time before shutting down the compressor.

The receiver and pipes into which the compressor discharges should be blown out regularly to remove any oil and water that might have accumulated, and especially should the discharge valves be inspected and cleaned at regular intervals, because if they stick they are likely to admit hot compressed air from the receiver back into the cylinder, thereby increasing the temperature of the air to such a high point before compression that it will reach the flash point of the oil during compression. It might also be added that the intake pipes should be so arranged that the free air is drawn in from the outside rather than from the engine room. This is important, because cold air gives a higher volumetric efficiency to the compressor, which means economy of power. Besides, it is also an effective way of decreasing the likelihood of explosions.

Underground Trolley Wire Protection

In recent numbers of the JOURNAL, there have been described various methods of constructing protecting troughs for underground trolley wires. V. V. Carr, in *Coal Age*, describes another method of protection, as shown in the accompanying illustration.

An iron strap is held by each trolley hanger, and boards bolted to these. If cut to length, they can be notched and joined at the hangers, as shown in Fig. 1. They should be wide enough and placed low enough to cover the point of greatest sag in the wire. Methods of attachment to rock roofs and to timbers are shown in Figs. 1 and 2, respectively. If the trolley hangers are spaced more than 15 ft. apart, intermediate straps should be provided for the boards.

In case it is desirable to carry the protection independently of the trolley-wire supports, the method shown in Fig. 3 is available. In this case the boards are merely lapped in the bracket and no bolting is necessary.

The bare trolley wire is a great danger underground. It is impossible to raise the wires so as to prevent contact with persons. It should be avoided by some such semi-inclosing device as this.

In Drilling and Blasting the Culebra Cut, both piston and churn drills have been used. The usual depth of hole, according to the Panama Canal Handbook for 1913, has been about 27 ft., the holes being spaced 14 ft. apart. They are loaded with 45% potassium-nitrate dynamite and fired by an electric current from a lighting circuit. About 2¼ cu.yd. of material is obtained per pound of powder. The explosive used is what is commonly called "straight dynamite," having a high velocity of detonation and good water-resisting qualities, but generating more noxious fumes than the gelatin or ammonia dynamites.

DETAILS OF METALLURGICAL PRACTICE

The Hardinge Mill

The various functions of the different types of Hardinge mill are described by H. W. Hardinge, in a paper presented at the February meeting of the American Institute of Mining Engineers. The Hardinge ball mill, as now constructed and used, comes into direct competition with stamps.

At the Porcupine Gold Mining Co., Porcupine, Ont., the material fed to the 4½-ft. ball mill is taken directly from a rock crusher, some of which exceeds two inches in diameter. Since a slime product is desired, the ball-mill discharge is further reduced in a 6-ft. by 72-in. Hardinge pebble mill. As shown by Table I, the pebble-mill product contains over 90% of —200-mesh material, with but

TABLE I.—RESULTS OBTAINED BY HARDINGE MILL, AT PLANT OF PORCUPINE GOLD MINING CO., PORCUPINE, ONT.

Mesh	+10	+20	+40	+80	+100	+200	—200
Feed to 4½-ft. Hardinge ball mill. (Crusher product through 1.5 in.)	88.56	4.17	7.0	....	....	....	.....
Product from 4.5-ft. Hardinge ball mill	8.50	18.4	20.78	15.0	3.30	34.0	.....
Product from 6-ft. by 72-in., Hardinge pebble mill	....	....	.....	0.65	4.92	3.56	90.87

a small percentage of material coarser than 100 mesh. For this installation the consumption of balls and lining is given as less than one pound per ton of ore ground.

Where a granular product is required, as for concentration, the 4½-ft. Hardinge ball mill is followed by a 6-ft. by 22-in. Hardinge pebble mill. An illustration of such an installation is that of the Beaver Consolidated Mines, Ltd., Cobalt, Ont., the results of which are shown in Table II.

TABLE II.—RESULTS OBTAINED BY HARDINGE MILL AT BEAVER CONSOLIDATED PLANT, COBALT, ONT.

Mesh	+6	+8	+10	+20	+40	+60	+80	+100	—100
Feed to 4.5-ft. Hardinge ball mill, (Crusher product through 1.5-in. screen on 0.25 in.)	....	....	....	....	....	....	....	...	....
Product from 4.5-ft. Hardinge ball mill	28.6	30.4	13.7	17.7	4.9	1.8	1.1	0.1	1.0
Product from 6-ft. by 22-in. Hardinge pebble mill	....	....	....	2.7	30.0	33.7	18.5	4.2	10.5

As further illustrating the wide range of the conical mill, in Table III are given the results of crushing in an 8-ft. Hardinge mill upon different classes of material,

TABLE III.—RESULTS OBTAINED BY HARDINGE MILL ON A VARIETY OF ORES

Mesh	+10	+20	+40	+60	+80	+100	+150	+200	—200	Tonnage	Horsepower
Calumet & Hecla Mining Co.											
Feed	52.3	39.7	6.3	1.0	0.7	....	....	....	....	...	.....
Product	....	0.02	0.15	2.1	6.55	6.0	16.9	26.7	40.8	50	37
Copper Range Consolidated Co.											
Feed	58.0	26.2	14.8	0.9	...	....	....	....	....	...	.....
Product	....	....	...	8.5	3.3	9.4	30.4	10.9	34.0	7.1	?
Federal Mining & Smelting Co.											
Feed	41.2	45.8	11.0	1.3	0.3	....	0.3	....	0.1	115	35.8
Product	....	0.1	8.0	15.6	16.4	14.5	7.0	13.4	25.0	...	.....
Miami Copper Co.											
Feed	25.3	32.7	10.1	1.8	0.8	0.7	0.8	0.4	7.3	180	35
Product	....	2.2	13.8	15.5	8.9	7.7	8.5	5.3	38.1	...	.....

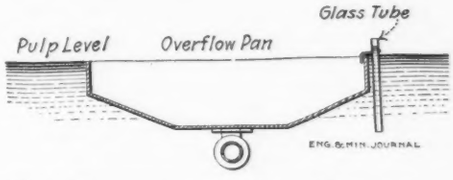
from flint-conglomerate ores of the Lake Superior copper district to the softer porphyry-copper ores of Arizona. Naturally, vastly different tonnages are obtained according to hardness and other physical properties.

Automatic Indicator for Drag Classifiers

By Donald F. Irvin*

The harmful effect upon the efficiency of drag classifiers of variations in the solid to liquid ratio of the pulp fed was clearly demonstrated at the mill of the Tigre Mining Co., El Tigre, Sonora, Mexico, during the winter of 1911-1912. At this mill five drag classifiers of the Esperanza type are used. Two of these handle the current mill pulp, while the other three are used in classifying the pulp discharged from the five tube mills.

When the mill was put in operation, a ratio of solution to ore was fixed. Having speeded shafting and pumps, and regulated valves accordingly, the classifiers handling the tube-mill discharge were assumed to be operating under the desired conditions. Work had not progressed far when it was found that temporary variations in the



Pulp Indicator for Drag Classifier

amount of dry pulp delivered to the classifier were sufficient to upset the requisite conditions for good classification and at times the classifier was sending fine sand into the slime overflow. These variations in feed were caused most often by irregular feed of dry sand from the sand-tailing reclaiming plant; from 50 to 75 tons of old concentrator sand tailing are delivered to the tube-mill department daily.

To remedy this condition, the spray pipe at the head of the classifier, which is used to dislodge any sand that sticks to the rakes, was opened wider. This caused the spray to shoot over into the body of the classifier where it acted as a diluent. At the same time enough solution dropped into the discharge launder to carry the sand to the tube mill. This expedient helped classification, but if carried to excess so that the slime discharge was truly slime, too much solution was sent to the Dorr thickener.

This method of regulation was obviously purely experimental and was trying to the operator of the plant. Recourse to hydrometric measurements was not to be thought of, as it would involve the use of fragile, high-priced hydrometers by husky, low-priced Mexican laborers. Furthermore, the necessity of making frequent hydrometric measurements was to be avoided if possible.

*Metallurgical department, Tigre Mining Co., Yzabal, Sonora, Tex.

A float hydrometer described by Charles F. Spaulding in the *Mining and Scientific Press* for use in agitating tanks, suggested the indicator which was worked out for the drag classifiers at Tigre mill. The device of Mr. Spaulding consisted of a piece of pipe 10 ft. long, equipped with a float and vertical scale. These hydrometers were left floating in the tank so that the thickness of the pulp, as evidenced by the reading on the scale, could be told at a glance.

The device used at the Tigre mill consists of a piece of 5/8-in. gage glass 10 in. long, which is suspended from the edge of the slime-overflow pan by means of a bent wire as shown in the accompanying sketch. When put into place the level of pulp inside the glass tube is naturally the same as that on the outside, but in a few minutes the meniscus begins to rise, the contents of the tube become clearer, showing that there has been a settling out of the solid particles, and a corresponding decrease in specific gravity; buoyed up by the heavier pulp outside of the tube, the level of the meniscus rises.

In practice, these tubes show the meniscus about 1/4 to 3/8 in. below the top of the tube, and about 1 3/4 in. from the meniscus to the level of the pulp. This position for the meniscus was chosen by experiment as the point at which, on El Tigre ore, the thickness of the slime overflow was such as to insure 90% of it passing a 200-mesh screen.

If the supply of solution for the classifier decreases, or the supply of ore increases unduly, the pulp becomes thicker, its specific gravity becomes greater, the internal column in the glass tube rises higher and higher, and even may steadily overflow the top of the tube. Should the ore supply slacken, or the solution supply increase, the internal column will, on the contrary, lower and tend to coincide with the level of the pulp outside.

The guide, therefore, to the proper running of the classifiers is extremely simple and can be condensed into the statement that 90% of the slime overflow will pass 200 mesh when the meniscus is 1/4 in. below the top of the tube. Seldom does there occur a large excess of solution, as with increased tonnage the pump capacity of the cyanide plant can hardly do more than keep the proper quantity of solution in circulation. A liquid to solid ratio of 5:1 or 5 1/2:1 in the classifiers insures the specified degree of sizing.

The setting of the tubes was done indirectly, by first varying the pulp thickness and observing the liquid to solid ratio, and the percentage of 200-mesh material in the slime overflow. Finding that 5 or 5.5:1 gave the desired results, the tube was measured for height of water column at those figures, and a datum level established for regular work.

These indicators are not used on the two concentrator-tailing classifiers as there is always a large amount of water in them and classification is uniformly good. This device is offered to the cyaniding community in the belief that it has not been used elsewhere for this purpose.

⁂

The Clearance Demanded by the Widest Gondola Car used in the United States is 11 ft. 2½ in., not 12 ft. 2½ in., as shown in an abstract in the "Journal" for Dec. 28, 1912. In this connection, it may be noted that the width of the New Orleans Great Northern cars 1305 to 1605 is not 12 ft. 7⅛ in. as shown in the Official Railway Equipment Register; the P. R. R. gondolas are the widest in use in the United States.

Precipitation and Refining, Yuanmi Mill, Western Australia

At the new mill of the Yuanmi Gold Mines, West Australia, the clarified solution is precipitated on zinc shavings in the usual manner (*Monthly Journ.* of Chamber of Mines of W. Aust., November, 1912). No especial care is necessary to get good results. The boxes are cleaned up once a month. Owing to the manner in which the gold plates the zinc, more short zinc is acid treated than is usually the case. But little free black slime is produced from these solutions; the zinc, when plated with gold, becomes hard and brittle. After acid treatment, the precipitate is roasted in a cast-iron muffle, and is fluxed with about 35% of borax and 5 to 10% of clean quartz sand. The bars are poured direct from a No. 9 tilting furnace into molds. The average value of the bullion produced (without any refining) is over £4 per oz. Clay-lined and ordinary graphite retorts have been tried and it is found that the latter yield bullion just as high in value as the former.

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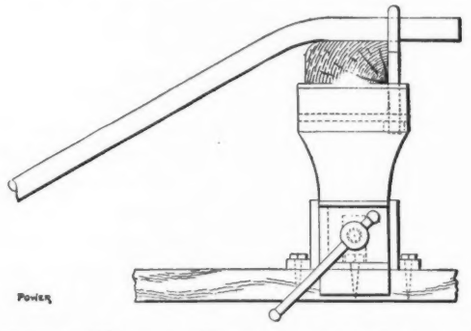
Emergency Pipe Bender

A quickly erected device for bending small pipe is described by Grover M. Hardy, in *Power*, Feb. 11, 1913. It consists of an eye-bolt set in a vise with a nut screwed



PIPE BENDER MADE OF EYE-BOLT AND BLOCK OF WOOD

on the end below the jaws. A block of wood, set on the vise, with its edge rounded, as shown, acts as a fulcrum and a form for the bend.

⁂

Oil Burning Assay Furnace at Pittsburgh-Silver Peak

At the Pittsburgh-Silver Peak Gold Mining Co., Blair, Nev., a Case No. 115 muffle assay furnace for fuel oil has replaced the furnace burning gasoline. The manufacturer's bulletin describing this furnace, states that formerly six gallons of gasoline per day was used, costing

COMPARATIVE OPERATING COSTS OF ASSAY FURNACES WITH DIFFERENT FUELS, PITTSBURGH-SILVER PEAK

Fuel Used	Amount Used	Cost per Ton or Gal.	Monthly Fuel Bill
Coal	2½ tons	$14.00	$35.00
Gasoline	190 gal.	0.25	47.50
Crude oil	175 gal.	0.06	10.50

25c. per gal.; now 5½ gal. of 14° Bé. crude oil are used, at a cost of six cents per gallon. The assay office fuel bill has thus been reduced from $47.50 to $10.50 per month. Incidentally the crucibles last twice as long as formerly. The accompanying table shows the comparative operating costs with different fuels.

United States Steel Corporation Report

SYNOPSIS—Summary of the report for 1912. The gross earnings for the year were $745,505,515; the production of 26,428,449 tons of iron ore and 12,506,619 tons of finished-steel products, beside byproducts and 10,114,500 bbl. cement. A year of active work, but low prices and moderate profits.

The annual report of the United States Steel Corporation for 1912 covers the operation of 149 blast furnaces and steel plants; 114 iron mines in the Lake Superior region and 22 in the Southern group; 104 coal mines and 74 coke plants in the Northern, 23 coal mines and 7 coke plants in the Southern group. The extent of iron lands owned is not given. Coal lands owned in the North include 134,400 acres coking coal, 93,571 acres steam coal and 24,217 acres surface; in the South 325,020 acres coal and 10,120 acres surface. The coke plants include 25,583 beehive and 1452 byproduct ovens. The transportation lines owned cover 976 miles main line and 758 miles branches, equipped with 1203 locomotives and 47,543 cars. Floating equipment includes three ocean steamers, 82 lake and river steamers and 126 barges.

Balance Sheet

The general balance sheet, in a condensed form, is as follows as of date, Dec. 31, 1912:

Capital stock, common	$360,281,100
Capital stock, preferred	508,302,500
Capital stock subsidary companies not held	591,543
Total stock	$869,175,143
Bonded debt, U. S. Steel	$453,937,000
Bonded debt, subsidiary companies	190,010,180
Total bonded debt	$643,947,180
Current liabilities	60,410,868
Reserve funds	25,250,673
Appropriated surplus to cover capital expenditures	40,000,000
Undivided surplus	136,716,245
Total liabilities	$1,775,500,109
Property accounts	$1,448,175,255
Deferred charges to operation	7,149,673
Investments	3,729,455
Sinking and reserve-fund assets	18,669,884
Inventories and current assets	297,775,842
Total assets	$1,775,500,109

In addition to the bonds outstanding there are $66,756,000 of various issues held by the trustees of the sinking funds.

Gross Receipts and Expenses

The account of gross receipts and expenses as given may be summed up as below, in condensed form:

Gross sales and earnings	$745,505,515
Rentals and miscellaneous	6,346,351
Profits of subsidiary companies on inventories, etc.	7,037,021
Total gross receipts	$758,888,888
Operating charges	640,962,486
Net earnings, for the year	$117,926,402

The operating charges, as stated in the report, include $634,089,326 manufacturing and producing costs and expenses, including repairs, $17,760,567 administrative and selling expenses; $13,781,669 taxes and interest; a total of $665,631,562, from which is deducted $24,669,076 for depreciation, shown in a separate item in other accounts.

The Steel Corporation is primarily a maker and seller of finished steel. The total quantity sold in 1912 was 12,506,619 tons. Without making allowance for byproducts, the gross sales show an average of $59.81 per ton; the net earnings, $6.24 per ton. This, of course, is only a rough approximation, but no closer figures are possible.

The following table shows how the statement of gross sales and earnings was made up in 1912, as compared with the previous year:

Gross sales:	1911	1912
To customers outside of corporations	$399,940,256	$494,637,808
Inter-company sales	160,218,864	189,257,318
Total sales	$560,159,120	$683,895,126
Transportation company earnings	48,937,697	53,665,603
Miscellaneous company earnings	6,052,023	7,944,786
Total gross earnings	$615,148,840	$745,505,515

The amounts given above represent the aggregate gross value of the commercial transactions conducted by the several subsidiary companies, and include sales made between the subsidiary companies and the gross receipts of the transportation companies for services rendered both to subsidiary companies and to the public. The earnings for the year resulting from the above business represent the combined profits accruing to the several corporate interests on the respective sales and services rendered each of which is in itself a complete commercial transaction.

Income and Surplus

The disposition of the net earnings shown above may be briefly stated as follows:

Net earnings as above	$117,926,402
Interest and sinking funds, subsidiary companies	$11,686,439
Interest and sinking funds, U. S. Steel bonds	29,247,850
Depreciation and extraordinary replacement	22,734,366
Sundry adjustments	17,698
Total charges	$63,686,353
Surplus for the year	$54,240,049
Dividends, 7% on preferred stock	$25,219,677
Dividends, 5% on common stock	25,415,125
Total dividends	$50,634,802
Balance	$3,605,247

No appropriations for new work were made from net earnings. Net expenditures on capital account during the year amounted to $13,780,362, including extensions at Gary and the new steel plant near Duluth.

Total expenditures for additional property and the retirement of obligations from the organization of the corporation in 1901 to Dec. 31, 1912, have been $549,083,054. These additions have been financed as follows: From sinking, depreciation and replacement funds, $47,019,399; from bond sinking funds, $69,713,784; from surplus net income, $163,694,423; from surplus appropiations, $143,923,786; from issue and sale of securities, $124,731,261. The additions to property were $424,351,793 in excess of the new obligations issued.

Shipments to customers outside of the organization in 1912 were as follows, divided into domestic and export sales:

	Domestic	Foreign	Total
Steel and other finished	10,299,890	2,233,570	12,533,460
Pig iron, spiegel, etc.	501,327	46,503	547,830
Iron ore, coal and coke	1,825,265	.....	1,825,265
Byproducts, etc.	70,453	723	11,176
Total	12,696,935	2,280,796	14,977,731
Cement, bbl.	10,047,573	.....	10,047,573

While the increase in the amount of business done in 1912 compared with 1911, as represented by tonnage of shipments of rolled steel and other finished products, equaled 32.5%, the increase in the gross selling value f.o.b. mills of the entire tonnage shipped, including cement, was but 23.7%; and the increase in total earnings (before deducting charge for interest on outstanding

capital obligations of the subsidiary companies) was only 5%. These relative differences are due principally to decreased prices received for products. The average price received for the entire tonnage shipped in 1912 was, in respect of the domestic business, about $3.30 per ton less than the similar average received in 1911; and for the export business, about $1.10 per ton less. Following the early months of 1912 prices for nearly all steel products, which at that time had reached the lowest level prevailing since 1898, began to improve and advanced gradually until in the latter part of the year, when they were about equal to the prices that obtained prior to the break commencing in May, 1911. At the close of 1912, the order books of the subsidiary companies showed a total tonnage of unfilled orders on hand of 7,932,164 tons of steel products. Since Jan. 1, 1913, the bookings of new business have been nearly equal to the very large output of the plants. At Feb. 28, 1913, the unfilled orders amounted to 7,656,714 tons.

Production

The production of the subsidiary companies for the year 1912 compared with the year 1911 was as follows:

PRODUCTION OF U. S. STEEL SUBSIDIARIES

Products	1911	1912
Iron Ore Mined		
in the Lake Superior Ore Region	Tons	Tons
Marquette Range	560,685	551,575
Menominee Range	1,105,044	995,401
Gogebic Range	1,264,734	1,497,950
Vermilion Range	1,182,075	1,301,663
Mesabi Range	14,581,530	20,001,953
In the Southern Ore Region		
Tennessee Coal, Iron & R.R. Co.'s Mines	1,239,563	2,079,907
Total	19,933,631	26,428,449
Coke Manufactured		
In beehive ovens	9,491,206	11,554,840
In byproduct ovens	2,629,006	5,164,547
Total	12,120,212	16,719,387
Coal mined, not including that used in making coke	5,290,671	5,905,153
Limestone quarried	4,835,703	6,124,541
Blast furnace production		
Pig iron	10,593,726	13,990,329
Spiegel	66,435	53,829
Ferromanganese and silicon	84,736	142,006
Total	10,744,897	14,186,164
Steel ingot production		
Bessemer ingots	5,055,696	6,643,147
Openhearth ingots	7,697,674	10,258,076
Total	12,753,370	16,901,223
Rolled and other finished steel products for sale		
Steel rails (heavy and light tee and girder)	1,568,028	1,857,407
Blooms, billets, slabs, sheet and tinplate bars	874,474	1,103,752
Plates	630,512	1,076,308
Heavy structural shapes	547,186	898,537
Merchant steel, bars, hoops, bands, skelp, etc.	1,221,606	1,910,512
Tubing and pipe	863,670	1,111,138
Wire rods	118,302	196,720
Wire and products of wire	1,613,754	1,629,717
Sheets (black and galvanized) and tin plate	1,079,046	1,508,607
Finished structural work	518,399	599,301
Angle splice bars and all other rail joints	160,855	192,488
Spikes, bolts, nuts and rivets	60,386	83,426
Axles	52,046	142,367
Steel car wheels	36,652	65,931
Sundry steel and iron products	131,332	130,408
Total	9,476,248	12,506,619
Spelter	28,333	31,318
Sulphate of iron	28,381	35,215
Universal portland cement, bbl.	7,737,500	10,114,500

Wages and Labor Conditions

On Feb. 1, 1913, a general increase was made in the wages and salaries of a large proportion of the employees of the subsidiary companies. These advances extended to about 75% of the total number of all employees, including substantially all of the wage earners theretofore receiving less than $2 per day. The 25% of employees not affected comprised very largely the higher paid wage earners and salaried employees. The increases were relatively higher in the case of the lower paid employees, averaging in the case of employees receiving less than $2 per day about 12½%. This advance in wage and salary rates calls for an increase of approximately $12,000,000 in the annual payroll, on basis of the number of employees in service during 1912. The rates of wages now paid by the Corporation to ordinary labor and to skilled workmen generally, are the highest in the history of the industry.

The 12-Hr. Day

The committee to investigate the labor conditions in the mills was unable to formulate any plan for eliminating entirely the 12-hr. day which is worked by about 25% of the mill employees. Owing to the great labor demand during the last year it would have been impossible, the company states, to operate fully in case the working hours had been generally reduced. It believes that it is impracticable to abolish the 12-hr. day without the coöperation of competing manufacturers, as the company reports that some of its men left its employ after the six-day week had been established, and had gone to work for other manufacturers where opportunity was given to work seven days per week. The committee is continuing its study of the problem, however.

There was set aside from the accumulated undivided surplus an additional $500,000 for permanent pension-fund reserve. During the year the Corporation paid over to the trustees of the United States Steel and Carnegie Pension Fund, the sum of $207,479 for current disbursements. The total income of the Trustees of the Fund for 1912 was $414,770, of which $207,290 was from the Carnegie fund. The total disbursements for pensions and relief were $402,163; for management, $12,607. There were 1843 ex-employees on the pension rolls.

Employees and Payrolls

The average number of employees in the service of all companies during the fiscal year of 1912, in comparison with the fiscal year 1911, was as follows:

Employes of	1912	1911
Manufacturing properties	161,774	140,118
Coal and coke properties	24,394	21,723
Iron ore properties	12,597	14,445
Transportation properties	19,438	17,963
Miscellaneous properties	2,822	2,639
Total	221,025	196,888
Total annual salaries and wages	$189,351,602	$161,419,031

Decrease in number of employees of iron-ore properties is due principally to lesser stripping and development operations conducted in the year under review.

In January, 1913, there was again offered to the employees of the Steel Corporation and of the subsidiary companies the privilege of subscribing for preferred or common stock. The subscription price was fixed at $109 per share for the preferred and $66 per share for the common stock. The allowances for special compensation or bonus to be paid subscribers who retain their stock were fixed at $5 per share per year for the preferred and $3.50 per share annually for the common stock. The conditions attached to the offer and subscription, aside from the features of subscription price and the amount of special compensation or bonus to be paid, were substantially the same as those under which stock has been offered to employees in each of the previous ten years. Subscriptions were received from 36,119 employees for an aggregate of 34,551 shares of preferred and 25,793 shares of common stock.

General Remarks

During the latter part of the year substantial appropriations were made for extensions and additions to the various plants and properties. No considerable amount of expenditures was, however, made on these authorizations during 1912. At the close of the year the amount unexpended on appropriations for construction and extraordinary replacements, including iron-ore mine stripping operations for 1913, equaled approximately $40,000,000. It is estimated, however, that only about $30,000,000 of this will be expended during 1913. These authorizations cover a wide range of sundry additions and improvements.

In order to meet in a more satisfactory manner the growing demands of the Canadian trade for the products of the subsidiary companies, it has been decided to establish a manufacturing plant in Canada at the site which the Corporation secured some years ago at Ojibway, Ont., opposite the City of Detroit, Mich. The site consists of about 1500 acres with a frontage of about a mile and a half on the Detroit River. The plans for the scope of the construction of the plant have not yet been fully developed, but will probably include blast furnaces, openhearth steel works, rail mill, wire mill, structural and bar mills; and perhaps some other mills. It is expected the cost of the plant will in part be financed by an issue of bonds.

The tonnage output of the manufacturing plants of the subsidiary companies located at Gary, Ind., during 1912 was the largest of any year since their construction, being as follows: Gary steel plant of Indiana Steel Co.: 1,093,578 tons of pig iron, 1,669,389 tons of openhearth steel ingots, 468,801 tons of openhearth steel rails and 717,702 tons of various other rolled-steel products. The byproduct coke plant produced 2,490,854 tons of coke. The production of the sheet plant was 139,520 tons of black and galvanized sheets, and at the bridge plant there were produced 83,018 tons of fabricated steel work.

Tariff Legislation

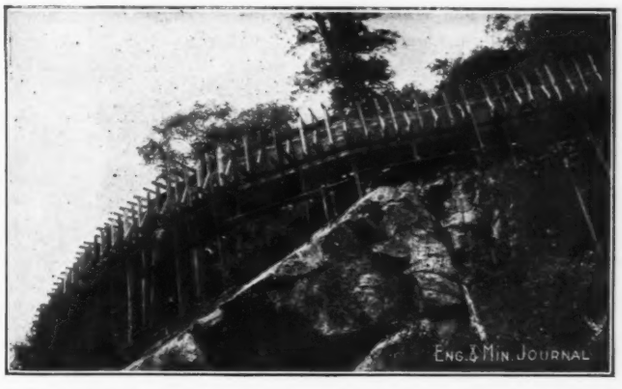
Washington Correspondence

The Ways and Means Committee of the House of Representatives has completed its work on the metal schedule of the forthcoming tariff revision, and has had a revised print of the measure made, on which it is now working for the purpose of improving the provisions of the plan so far as possible. It is understood that this revised draft varies only in minor particulars from the so called Underwood bill of 1912. There will, however, be decidedly important changes in the sections relating to metals other than iron and steel, and particularly in the provisions with reference to smelting in bond, which have, for a long time, been a source of criticism and dissatisfaction. It is understood that the revised draft of this schedule was shown to President Wilson some day ago, and that it was determined not to pay much further attention to the extreme protests of iron and steel interests which object to the proposed Underwood cut, but to go ahead, relying upon the fact that in the past the industry has apparently profited from the reductions in duty that were forced upon it by Congress. The prospect that a bill making as many reductions as were proposed in the Underwood measure of last year would actually be presented to the President for signature has caused considerable excitement among members of the metal trades and they have been doing active work in the Senate with a view to defending themselves against the proposal when it reached the Upper Chamber. Through the assistance of Senators from the mining states, the metal men are at least assured of a thorough hearing before anything is done in the Senate.

Reconstruction of an American River Flume

By Lewis H. Eddy

The American River power plant of the Western States Gas & Electric Co., near Placerville, Calif., was repaired and partially reconstructed in 1912, by H. M. Byllesby & Co., of Chicago, at an approximate cost of $100,000 and the use of 1,000,000 b.ft. of lumber. The repairs and reconstructions included five miles of flume, two miles of ditch, the forebay, sluice gates, fishladder and some minor parts. The work was completed without interrupting the flow of water, the generating of electricity, or the transmission of the power and light current; also without



Section of Reconstructed Flume on American River

human accident, although the number of men employed ranged from 170 to 190, many of them often occupied in dangerous situations. During the period new work also was maintained for six months at Placerville in connection with extension of transmission lines. Five working camps were maintained.

The Western States Gas & Electric Co. is one of the properties of H. M. Byllesby & Co., and was established in California in 1911 by taking over the American River Electric Co. at Placerville, Eldorado County, and the Stockton Gas & Electric Co. at Stockton, San Joaquin County. The Stockton plant was built in 1903 and used steam power for generating electricity. The steam plant is now maintained as an auxiliary. The American River power plant generates the electric current for the Placerville and Stockton transmission plants.

The power house near Placerville, is equipped with two 1500-kw. generating machines, using about 100 second-feet of water under 590-ft. head, driven by combined Pelton and Doble waterwheels. The water is taken from the south fork of American River, through a total length of seven miles of ditch and flume, having a vertical drop of 800 ft. The penstock is 1500 ft. long. The diversion dam is 25 ft. high, situated 11 miles north of Placerville. There are two transmission lines into Plac-

erville. These extend in two branches to a point between Folsom and Sacramento where they are joined and form a main line to Stockton. The Folsom line is 32 miles long; the Stockton line is 92 miles long. The company supplies electric light and power to the dredges of the Natomas Consolidated and extends its service into mining districts of the Mother Lode region between Placerville and Stockton, and to Lodi and other towns in the vicinity of Stockton and Placerville.

Oregon Fir Used

The interesting feature of the repair and reconstruction was the work done on the flume, a great deal of which was in the nature of new construction. The flume was built in 1903. It is 6x6 ft., put together in 16-ft. sections. About 80% of the posts used for underpinning in the original construction were set on the ground or on slippery solid rock, without hitches or other form of secure foundation or footing. The new posts are set in solid rock footings provided by the cutting of hitches. The course of the flume follows generally the contour of the hills, which in many places pitch under and away from the flume at angles varying from 20 to 80° from horizontal. In many other places the hills in line with the course of the flume are precipitous. A number of sections of the underpinning of the flume were of necessity wholly rebuilt of new lumber, and repairs of some sort were necessary along almost the entire length of the flume structure. Most of the new posts are 6x8 in. in section and vary in height from 14 to 18 ft. Oregon fir was used for posts on account of withstanding wetness or moisture to a greater degree than other available woods. All of the lumber used in this work was shipped from Oregon, by the Dalles Lumber Co., of Dalles, and the Monarch Lumber Co., of Portland.

The underpinning is constructed in sets placed eight feet apart. Each set is composed of three posts, a cap and brace. The outside posts stand at an angle of 80° from the horizontal level of the caps. Posts 14 ft. high and under are of 6x6-in. timber; posts over 14 ft. high, of 6x8-in. The cap is 6x6 in. by 8 ft. long, the ends projecting 10 in. beyond the outside posts. The brace is of 2x6-in. material and extends from the top edge of the cap next to the hill to the foot of the outer post and is nailed to the three posts and the cap. The three girders are 6x8 in. by 16 ft. long in each section. The girders rest edgewise on the caps and are placed directly above the tops of the posts in line with the outside edges and center of the flume body.

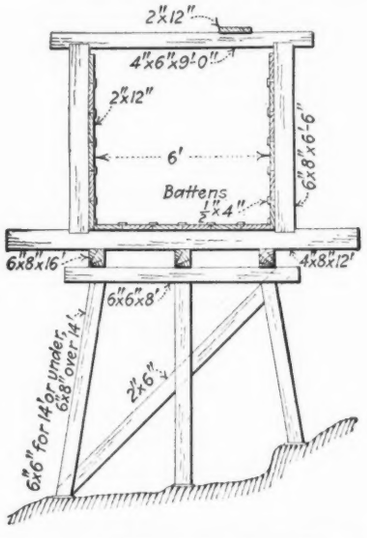
The frame sets holding the bottom and side planking of the flume, placed two feet apart, are constructed of four pieces each, a sill, two side sticks and a cap. The sill is 4x8 in. by 12 ft. long resting crosswise on the girders. The side sticks are 6x8 in. by 6 ft. 6 in. high, the ends mortised into the sill and cap. The cap is 4x6 in. by 9 ft. long, the ends projecting eight inches beyond the outside edges of the side sticks. The under side of the cap stands three inches clear of the top edges of the side planking of the flume. The ends of the sill project 2 ft. 4 in. beyond the outside edges of the side sticks, allowing for corner braces.

The body of the flume is composed of 2x12-in. planks, six in the bottom and six on each side. The bottom edges of the sides rest on the sills. The exact inside dimension is 6 ft. wide by 5 ft. 10 in. deep. The joints are calked with oakum and covered with battens 1½ by 4 in. The flume is uncovered, but provided with a running board of 2x12-in. planks.

Flume Sections Lifted by Jacks to Place Supports

The method of proceeding with the repairs to the underpinning was based on simple but effective engineering practice, but the labor was in many instances difficult and dangerous, owing to the volume of water flowing through the flume. Footings for the underpinning posts were secured by cutting hitches in the granitic rock formation. Where the rock was not exposed to the surface, trenches were dug into the soil until solid rock was reached. The underpinning sets were placed and the flume lifted in sections with hydraulic, ball-bearing and common screw jacks. Other hitches were also cut in the rocks to provide foundations for the jacks. These hitches will be useful for the same purpose in making future repairs requiring the lifting of the flume.

One section at a time was lifted four to eight inches clear of the old girders, where new ones were necessary, the new girders inserted, and the flume lowered to its



Cross-section of Reconstructed Flume of an American River Plant

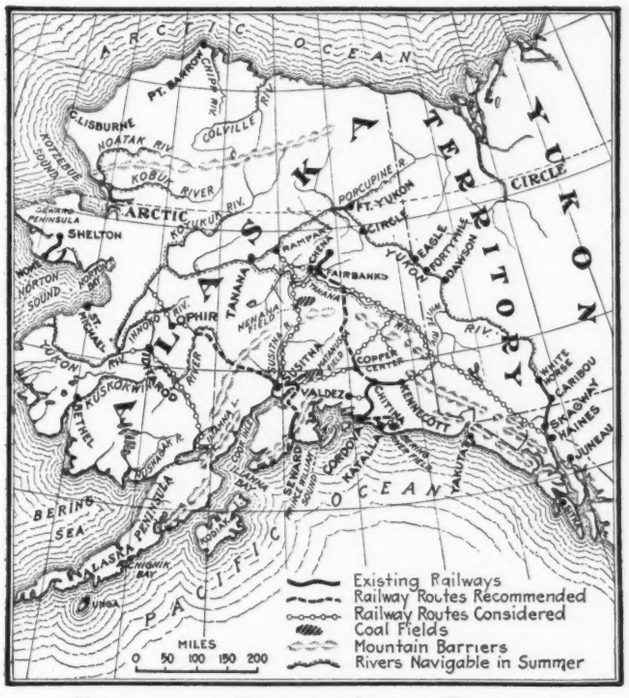
former position. A large amount of calking was necessary to fill in the leaks caused by lifting the flume and breaking the seams and joints of the body of the flume. Dirt was thrown in after each lift to lessen the leakage temporarily, and the seams and joints were packed with oakum. The difficult part of the labor was lifting the sections with such precision as to prevent the dropping out of a section under pressure of the volume of water which weighs about one ton to the running foot. An accident of this character would have caused loss of life, in all probability, wrought costly destruction to the structure, and interrupted the operation of the entire plant.

An interesting item in the distribution of costs of the work was the expenditure of $10,000 for digging trenches and cutting hitches for post footings and foundations for the jacks. Only skilled rock men were employed for the cutting of hitches. Likewise, the division of all labor employed on repairs and reconstruction was, so far as possible, based on the selection of men specially fitted for the various branches of work. The result is that the

flume structure is now more substantial than when originally constructed. Malcom McCalman, construction superintendent for H. M. Byllesby & Co., superintended the work.

Alaska Railways Recommended

The report of the Alaska Railroad Commission was transmitted to Congress by President Taft on Feb. 6. The commission, consisting of Maj. Jay J. Morrow, Alfred H. Brooks, Leonard M. Cox and Colin M. Ingersoll, was appointed Aug. 31, 1912, and spent the time from Sept. 15 to Nov. 9 in thoroughly examining what may be termed the central-southern portion of Alaska. A supplementary examination was made of some of the railroads and terminals of British Columbia. In considering and recommending railway routes, the commission bore in mind the necessity of transportation to tidewater of coal from the two best fields, the development of the country in the interior and the necessity of suitable tidewater terminals.



EXISTING AND PROPOSED ALASKA RAILWAYS

The routes considered, shown in the accompanying map, were divided into classes as follows: (1) Those which reached the interior but did not give economical access to the principal coal fields. (2) Those which served the coal fields only. (3) Those which reached the interior and by means of branches also provided transportation for the coal.

After considering the question of first cost, operating cost and probable traffic to be expected, the commission recommends the construction of the following railroads: (1) Chitina to Fairbanks, 313 miles, costing $13,971,000. (2) Bering River coal branch via Lake Charlotte, 38 miles, costing $2,054,000. (3) Kern Creek to Susitna Valley, 115 miles, costing $5,209,500. (4) Matanuska coal branch, 38 miles, costing $1,616,000. (5) Susitna Valley, Kuskokwim, 229 miles, costing $12,760,500.

The location of these lines can be seen on the map. The first route involves the use of the present Copper River road to Chitina, using Cordova for a terminal, and opening up the Fairbanks district, while providing a short branch to bring Bering River coal to tidewater. The country to the west, comprising the Susitna Valley and the Kuskokwim, and including Iditarod, is to be opened by the other lines, with a branch to the Matanuska coal fields. This involves using the road already built inland from Seward. The commission urges unanimously that this development be undertaken at once and prosecuted with vigor, in order to insure low-transportation charges and consequent rapid settlement of this new land and the utilization of its great resources.

Accidents in Metal Mines in 1911

An inquiry just completed by Albert H. Fay, mining engineer, of the U. S. Bureau of Mines, shows that fatal accidents in metal mines in the United States are more numerous in proportion to the number of men employed than are the fatal accidents in coal mines. Of the 165,979 men employed in the United States during the calendar year 1911, in the metal and nonmetal mines excepting coal, 695 were killed, which represents a rate of 4.19 per 1000 men employed, as compared with 3.73 per 1000 for the coal mines of this country for the same period.

The total number of fatalities and serious and slight injuries due to accidents is as follows: Deaths, 695, or 4.19 per 1000 men employed; serious injuries, 4169, or 25.12 per 1000; and slight injuries 22,408, or 135.01 per 1000. Of the total number of fatalities 532 occurred underground, or at the rate of 5.18 per 1000 and 153 were killed on the surface, or 2.49 per 1000.

The figures show that approximately two-thirds of the total deaths and injuries that occur in and about metal mines were caused as follows:

Of the fatal accidents, 32.52% are due to falls of ore or rock from roof, wall, or bank; 11.23% to explosives; 15.39% to falling down stope, shaft or winze; and 5.32% to mine fires.

Of the serious accidents, 31.37% are due to falls of roof, wall, or bank; 19.05% to car and haulage systems; 12.19% to machinery; and 6.41% to timber and hand tools.

Of the slight accidents, 28.86% are due to falls of roof; 15.52% to car and haulage systems; 10.10% to machinery; and 8.02% to timber and hand tools.

COPPER AND IRON MINES SHOW HIGHEST DEATH RATES

The figures for the copper mines show 396 operators employing 44,693 men, of whom 31,557 were employed underground and 13,136 on the surface. The total number of deaths and injuries due to accidents reported is as follows: Deaths 238, or 5.33 per 1000 men employed; serious injuries, 1326, or 29.67 per 1000; and slight injuries, 9016, or 201.73 per 1000. Of the total number of fatalities, 199 occurred underground, making this rate, per 1000 men employed, 6.31. The surface fatalities were 39, or 2.97 per 1000.

The figures for the iron mines show 207 iron-mine operators, who employed 45,953 men, of whom 25,461 were employed underground and 20,492 as surface men, including those engaged in steam-shovel work. The number of deaths and injuries resulting from accidents in these mines is as follows: Deaths 197, or 4.29 per 1000 men employed; serious injuries 2032, or 44.22 per 1000; and

slight injuries 8690, or 188.3 per 1000. Of the total number of fatalities, 136 occurred underground, or 5.34 per 1000 men, and 61 employees were killed while engaged in surface work, making this rate 2.95 per 1000.

The figures for the lead and zinc mines refer only to those in the Mississippi Valley. The lead and zinc mines of other states are grouped with miscellaneous metal mines on account of the difficulty of making a distinct classification, as lead and zinc occur in so many places as associated metals in silver ores, as, for instance, in the lead-silver mines of the Cœur d'Alene district, Idaho. The Mississippi Valley lead and zinc mines form a class by themselves and hence are easily segregated.

Incomplete Reports for Nonmetal and Miscellaneous Metal Mines

The statistics given embody the reports of 483 operators employing 12,521 men, of whom 9247 are underground employees and 3274 surface men. The total number of deaths and injuries due to accidents is as follows: Killed 43, or 3.43 per 1000 men employed; serious injuries 177, or 14.14 per 1000; and slight injuries 1311, or 125 per 1000. Of the number of men killed, 32 fatalities occurred underground, making this rate 3.46 per 1000 men employed, while 11 men were killed on the surface, or 3.36 per 1000 men.

The figures for the miscellaneous metal mines show 3817 operators, employing 48,919 men, of whom 35,176 were underground and 13,743 surface men. The deaths and injuries due to accidents are as follows: Deaths 193, or 3.95 per 1000 men employed; serious injuries 540, or 11.04 per 1000; slight injuries 3078, or 62.92 per 1000. Of the total number of fatalities, 163 occurred underground, or 4.63 per 1000, and 30 on the surface, or 2.18 per 1000.

Mississippi Lead and Zinc Mines Make Good Showing

The rates of serious and slight injuries are low when compared with the iron and copper mines. This may be accounted for in part by reason of the fact that this group includes many prospectors and small mines that keep no records. Fatal accidents impress themselves on the memory and are easily reported. The serious and slight injuries are soon forgotten if not recorded. Many of these mines are in states where there is no inspection, and they are not required to keep accident records. Many of the larger companies operating gold and silver and lead-silver mines of the West have, for their own protection, hospital service and medical aid for their employees. The reports from some of these large companies show that excellent records are being kept.

The nonmetal mines employed 13,893 men, of whom 3182 were employed underground and 10,711 on the surface. The total number of deaths and injuries due to accidents reported is as follows: Deaths 24, or 1.73 per 1000 men employed; serious injuries 94, or 6.77 per 1000; and slight injuries 313, or 22.53 per 1000. When compared with the copper and iron mines, these ratios seem exceedingly low. Judging from the reports received, this is largely accounted for by the fact that the mines, being small and employing an average of only 42 men each, do not keep complete records. The majority of these mines are in states where there is no state inspector, and are therefore not obliged to keep accident records and make reports thereon.

Dwight & Lloyd Sintering Process

Owing to the rapid extension of the Dwight & Lloyd sintering system, it has been found expedient to divide the territory and incorporate a new company, the Dwight & Lloyd Sintering Co., Inc., which will handle all business in North American countries. Patent rights for these countries have been duly transferred.

The Dwight & Lloyd Metallurgical Co. will continue to own and administer such of the Dwight & Lloyd foreign patents as have not been otherwise disposed of, especially in Australia and South America. It will also continue general metallurgical-research work as heretofore.

The treatment of iron ores by the Dwight & Lloyd process will remain as heretofore in the hands of the special licensee for iron and steel ores in North American countries, the American Ore Reclamation Co., 71 Broadway, New York.

Beside the regular chain of Dwight & Lloyd patents, some new patents have been acquired, such as the patent of Perkins and Cox, covering broadly the use of an ignited inflammable gas for kindling a mass of material to be sintered. (U. S. pat. 852,611, May 7, 1911); the Perkins and Requa patent relating to certain phases for variations of the Dwight & Lloyd process and apparatus, represented in U. S. pats. 951,198 and 951,199, Mar. 8, 1910; the S. D. Weeks patent (916,903, Mar. 30, 1909), covering a stationary grate or sintering hearth in combination with a traveling distributing hopper and igniter.

Arthur S. Dwight, one of the original patentees, remains in direct charge of the operations of both the Dwight & Lloyd Sintering Co. and the Dwight & Lloyd Metallurgical Co., and will continue to give his personal attention to the direction of the business. The offices of both companies, which are now at 25 Broad St., will be moved on May 1, to rooms 1500-1502, Columbia Building, 29 Broadway, New York.

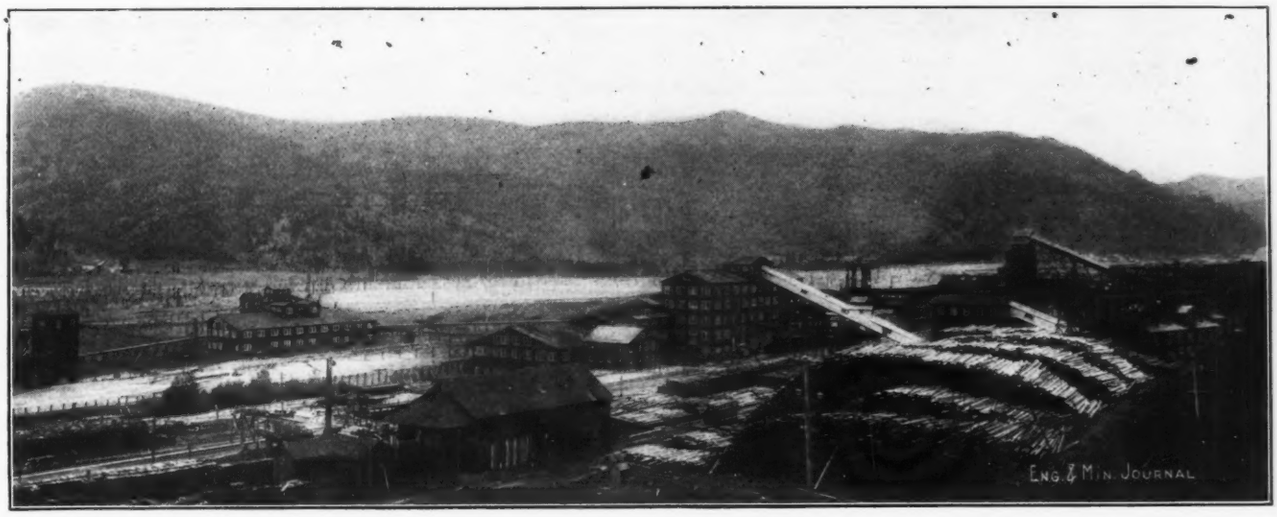
Allis-Chalmers Manufacturing Co.

Directors of the Allis-Chalmers Manufacturing Co., formed to succeed the Allis-Chalmers Co. met in New York on Mar. 17, 1913, and completed their organization by electing officers. John H. McClement, of New York, was made chairman of the board of directors, and Otto H. Falk, of Milwaukee, president of the company.

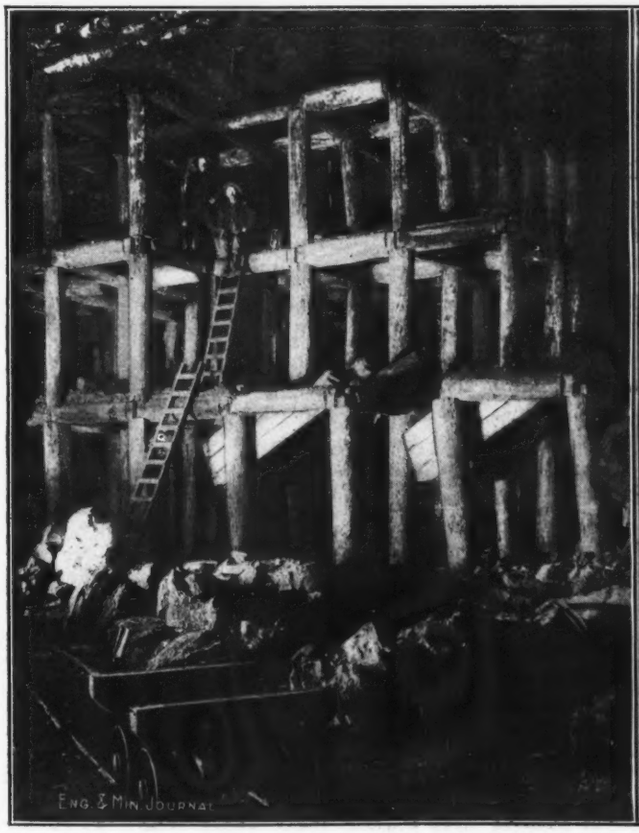
The executive committee chosen was Frederick Vogel, Jr., president of the First National Bank of Milwaukee; Gustave Pabst, chairman of the Pabst Brewing Co.; J. D. Mortimer, president of the Milwaukee Heat, Light & Traction Co.; Oliver C. Fuller, head of the Wisconsin Trust Co., of Milwaukee, and Messrs. McClement and Falk. The other directors of the company are Max Pam and F. O. Wetmore, of Chicago, Arthur W. Butler, Charles W. Cox, Oscar L. Gubelman, R. G. Hutchins, Jr., Arthur Coppell, and William C. Potter, of New York, and James P. Winchester, of Wilmington.

A call is issued for the rest of the amount due on assessments as follows: On preferred stock $4 payable on Apr. 24, and $4 on May 15, 1913; on common stock, $2 on Apr. 24 and $2 on May 15, 1913. It is stated that the lines of manufacture which were produced by the old Allis-Chalmers Co. will be continued. The new company is capitalized at $42,500,000, and is said to have a substantial working capital through assessments on stock.

PHOTOGRAPHS FROM THE FIELD



MILLING PLANT OF THE BUNKER & SULLIVAN MINING & CONCENTRATING CO., KELLOGG, IDAHO
(Photograph furnished by Robert N. Bell, state inspector of mines of Idaho)



TIMBERED STOPE ON THE 200-FT. LEVEL OF THE HOMESTAKE MINE

HOISTING A MULE AT THE HOMESTAKE MINE, SOUTH DAKOTA

(Copyright by W. B. Perkins)

American Smelting & Refining Co.

The fourteenth annual report of the American Smelting & Refining Co. covers the year ended Dec. 31, 1912. While the disturbances in Mexico interfered with traffic between the mines and smelting plants in that country, yet by reason of economies in operation, production in territories tributary to the widely scattered works of the company, opening of new property in the Southwest, and the high prices of silver and copper, the gross profit of the company showed an increase of $1,647,374 over the preceding year.

CONSOLIDATED INCOME ACCOUNT FOR 1911 AND 1912

A. S. & R. Co. and A. S. S. Co.

	1911	1912
Earnings of smelting and refining operations, repairs and replacements not deducted	$14,045,354	$15,016,135
Less repairs and replacements	1,944,593	2,447,300
	$12,100,761	$12,568,835
Earnings from mining property	2,000,187	3,113,105
Other earnings and income	1,011,177	1,077,560
Gross income	$15,112,125	$16,759,500
Deduct:		
Corporate and excise taxes	114,198	123,917
Administrative expense	767,982	758,177
Depreciation and amortization	1,887,399	3,013,543
Research and examination expenses	.....	159,619
Employees' bonuses and pension reserve	.....	367,823
Total deductions	2,769,579	4,423,079
Net income before deducting fixed charges	12,342,546	12,336,421
Fixed charges and preferred stock dividends:		
Interest and discount on A. S. S. debenture bonds	870,833	950,000
Dividends on A. S. & R. preferred stock	3,500,000	3,500,000
Dividends on A.S.S. preferred stock	2,520,000	2,520,000
	$6,890,833	$6,970,000
Net income in excess of fixed charges and preferred stock dividends	$5,451,713	$5,366,421
Less dividends on A. S. & R. common stock	2,000,000	2,000,000
	$3,451,713	$3,366,421
Adjusted surplus as at Jan. 1	11,148,223	13,699,726
	$14,599,936	$17,066,147
Deduct:		
Depreciation in investments	900,210	306,745
Surplus as at Dec. 31, as per consolidated balance sheet	$13,699,726	$16,759,402

CONSOLIDATED BALANCE SHEET FOR TWO YEARS

A. S. & R. Co. and A. S. S. Co.

Assets

	1911	1912
Net value of property account after deducting depreciation and new construction	$139,963,733	$140,063,528
Investments, book value	1,585,670	1,010,537
Deferred charge, discount on A. S. S. Co.'s debenture bonds	704,167	654,167
Insurance fund securities, at cost	232,555	229,601
Metal stocks, book value of refined metal (a)	32,473,186	36,141,013
Less unearned treatment charges	5,980,205	6,479,994
	26,492,981	29,661,019
Materials and supplies	2,566,872	2,783,114
Prepaid expenses	400,149	327,185
	2,967,021	3,110,299
Accounts collectible	4,236,519	4,387,563
Loans to affiliated companies	333,705	349,744
Demand loans secured by copper in process	3,192,049	5,935,874
Cash	5,890,708	3,809,374
	$13,652,981	14,482,555
	$185,599,108	$189,211,706

Liabilities

A. S. & R. common stock	$50,000,000	$50,000,000
A. S. & R. preferred stock	50,000,000	50,000,000
A. S. S. Co. preferred A	17,000,000	17,000,000
A. S. S. Co. preferred B	30,000,000	30,000,000
A. S. S. Co. debenture bonds	15,000,000	14,495,000(b)
Accounts, drafts and wages payable	5,165,065	6,773,297
Deferred payments on mining properties	550,000	440,000
Accrued bond interest	379,125	412,605
Unclaimed dividends	15,760	44,272
Dividends payable	2,501,667	1,873,105
Accrued taxes	198,493	244,809
	8,810,110	9,788,088
Employees' benefit funds	394,436	500,000
Fire insurance reserve	335,948	327,500
Miscellaneous	358,888	341,715
	1,089,272	1,169,215
Profit and loss	13,699,726	16,759,402
	$185,599,108	$189,211,705

(a) Does not include metals on hand refined for tolls and deliverable to consignors.

(b) After deducting $505,000, the par value of bonds in sinking fund.

In recognition of the loyal service of employees, the sum of $367,822 was appropriated, part of which was distributed as a cash bonus and the rest added to the pension fund to bring it up to $500,000. The research and examination expenditures were paid from the gross income. Notwithstanding these unusual charges and the increased amounts written off from book value of investment securities and for amortization of property, the net income for the year shows an increase of $508,173 over 1911. The profit and loss surplus, after the payment of dividends, was increased by the amount of $3,059,676. The total amount expended in the upkeep and expansion of the company in 1912 was $5,560,638, of which $99,795 was added to the book value of the property account. The balance sheet and income statement of American Smelting & Refining Co. and American Smelters Securities Co. are given herewith.

The $500,000 appropriated for the creation of a pension fund is to be invested at the discretion of the finance committee. Under the rules and regulations of the pension board, composed of three members of the executive committee, all men employees 65 years of age and over and all women employees 60 years and over, who have been continuously in the employ of the company (or any of the companies acquired by the American Smelting & Refining Co.) for 20 years, may be retired. Such pensioners will receive an allowance of 1%, for each year of service, of the average annual pay during the 10 years next preceding retirement, but no pension to exceed $200 per month or be less than $20, subject, however, to such exceptions as many be recommended by the pension board and approved by the executive committee. It is believed by mortuary experts that the income from the investment of the $500,00 w ll be sufficient to meet all requirements for several years.

Frederick W. C. Schniewind

Dr. Frederick W. C. Schniewind, whose death was briefly noted last week, died at his residence, Englewood, N. J., Mar. 12, following an operation for appendicitis about two weeks prior to that time.

Doctor Schniewind was born at Bochum, Westphalia, Germany, Oct. 23, 1861. He received the degree of Ph.D. at Heidelberg University, and having been educated as a chemist, he took up work in the iron and steel branch in Germany. He came to America when 28 years old and pursued similar work in the West. He was then, for a short time, at Cleveland, Ohio, and eventually became interested in the introduction of byproduct coke ovens in America and arranged to represent the well known firm of Dr. C. Otto & Co., Dahlhausen, Germany. The patent rights of the C. Otto coke oven in America were secured by the Otto Coke & Chemical Co., a company which was incorporated about 1893 to introduce coke ovens of the Otto type in America. Doctor Schniewind's activities were mostly with the company which was next incorporated, the United Coke & Gas Co. The chief work in which he was a pioneer was the adaptation of the byproduct coke oven for the manufacture of illuminating gas, as carried out in the large plant of 400 ovens built at Everett, near Boston, Mass., about 1898. At the time of his death he was president of the German-American Coke & Gas Co., and its subsidiaries, the United Coke & Gas Co. and the American Coke & Gas Construction Co.

Since August last he had been the sole owner of these companies.

During his career he wrote articles for technical papers which have had wide circulation and were favorably received. His paper before the International Engineering Congress at Glasgow in 1901, entitled "Production of Illuminating Gas from Coke Ovens" is still in demand. Although German born and educated, he had exceptional command of the English language, as is evidenced by the exactness with which he used it. Indeed, he was an unusually clear and forcible writer on technical subjects.

He was a member of many societies and was much interested in the work done by technical associations. These societies included the Inventors' Guild, Franklin Institute, Engineers' Club, Chemists' Club, Deutscher Verein, Whitehall Club, American Gas Institute, Englewood Club, Verein Deutscher Ingenieure, Deutsche Chemische Gesellschaft, Verein Deutscher Eisenhuettenleute, Germanistic Society, Society of Chemical Industry, American Institute of Mining Engineers, American Society for Testing Materials, Illuminating Engineering Society, American Forestry Association, National Commercial Gas Association, Deutscher Verein fuer Gas- u. Wasserfachmaenner, Technischer Verein von New York, Verein Deutscher Chemiker, American Museum of Natural History, New York Zoölogical Society, National Geographical Society, Weinheimer Alter Herren Vereinigung and the American Association for Advancement of Science.

Doctor Schniewind was deeply interested in every phase of his subject, and his library hardly has an equal in America in the coke and gas field. He was survived by a wife and two sons. He was a man of great industry and exceptional acuteness of mind, and was a master of his chosen subject; having in addition a wide knowledge of general chemistry, and of economic conditions affecting the gas and chemical industries.

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George E. Gunn

George E. Gunn, whose death at Salt Lake City, Utah, Mar. 11, was briefly noted last week, was born at Mentor, Ohio, June 24, 1862. He received his education in the public schools, later taking a course at Oberlin College in civil engineering, and finished by attending the State University at Columbus. In 1884 he went to Butte, Mont., and worked as a miner. He was at Cable, Mont., for two years and then moved to Granite Mountain, where for 2½ years he held various positions in the mines. He returned to Butte in 1889 and was again in the mines for a year, then went to Neihart and Winston, Mont., where he was employed as assayer, mine foreman and superintendent for five years. In 1895 Mr. Gunn went with the American Smelting & Refining Co., at Helena, Mont., as ore purchaser, mining expert and manager, having many properties to look after. In 1901 he was sent to Salt Lake City and remained with that corporation until 1905, when he became connected with the Guggenheim Exploration Co.; but in the autumn of that year he started in business for himself, buying and operating mines in conjunction with William B. Thompson, of New York.

Their first purchase was the Cumberland-Ely mine. In November, 1905, they organized the Coppermines Co. with properties at Ely, Nev., and the Mason Valley Mines Co., which is the owner of properties at Mason, Nev., and a smeltery at Thompson, Nev. Mr. Gunn, through the Gunn-Thompson Co., became heavily interested in the Inspiration Copper Co., and developed its properties until it was taken over by the Inspiration Consolidated Copper Co. The Gunn-Thompson Co. is also the controlling owner of the Magma Copper Co., of Superior, Ariz., and the Barker Mines Co., of Barker, Mont., and is interested in the Gunn-Quealy Coal Co., of Gunn, Wyo. The company is also interested in many other mining operations.

At the time of his death, he was president of the Gunn-Thompson Co., vice-president of the Mason Valley Mines Co., president of the Mentor Land Co., of Wyoming, director of the Gunn-Quealy Coal Co., vice-president of the Desert Trading Co., of Wyoming, director of the National Copper Bank of Salt Lake City and of the First National Bank of Ely, Nev. Mr. Gunn was a member of the Rocky Mountain Club of New York, the Alta Club and the Commercial Club, of Salt Lake City. He was a Knight Templar and Shriner.

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Phosphate and Oil Lands in Idaho

Full provision has been made by Congress for the selection of phosphate and oil lands in Idaho with a view to developing the mining of those articles in that state. Sec. 1 of the new law now officially made public reads as follows:

That from and after the passage of this Act unreserved public lands of the United States in the State of Idaho which have been withdrawn or classified as phosphate or oil lands, or are valuable for phosphates or oil, shall, if otherwise available under existing law, be subject to selection by the State of Idaho under indemnity and other land grants made to it by Congress whenever such selections shall be made with a view of obtaining or passing title, with a reservation to the United States of the phosphates and oil in such lands, and of the right to prospect for, mine, and remove the same.

Locations may be made as on other public lands, subject to obligation to make good any damage to surface lands held under grants from the state, or to the state itself.

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International Congress in 1915

The sixth International Congress of Mining, Metallurgy, Applied Mechanics and Practical Geology, one of the largest of the scientific and industrial congresses, is to be held in London in the early part of June, 1915. These congresses take place at intervals of five years; the last was held at Düsseldorf in 1910, previous congresses having been held in Paris and Liège. The attendance at the Düsseldorf congress was over 2000, and it is expected that the attendance in London in 1915 will be equally large. An influential committee has been formed to make the necessary arrangements and the movement is being actively supported by the University of London, Imperial College of Science and Technology, Geological Society of London, Institution of Mechanical Engineers, Iron and Steel Institute, Society of Chemical Industry, Institution of Mining Engineers, Institution of Mining and Metallurgy, Institute of Metals, South Wales Institute of Engineers, Cleveland Institution of Mining Engineers, West of Scotland Iron and Steel Institute, Staffordshire Iron and Steel Institute, Sheffield Society of Engineers and Metallurgists, and by numerous firms interested in the various industries represented.

CORRESPONDENCE AND DISCUSSION

Cold Weather Concrete

On page 278 of the JOURNAL of Feb. 1, I notice an article entitled "Cold Weather Concrete." The experience I have had with concrete in New Ontario, where the winters are cold and steady, may be of interest to the readers in general and may bring out some discussion to the benefit of all who are obliged to undertake the placing of concrete in winter weather.

In the winter of 1909, we put in a concrete foundation for a compressor in a temperature of zero or lower and gave the concrete no protection from the cold. The concrete, of course, froze solid. In the winter of 1910, we put in all the foundations for our No. 1 plant, consisting of storage bins and crusher foundations in similar weather, and in this case did not protect the concrete from the cold. In the winter of 1912, we put in all the foundations, floors, basements, concrete transformer station, concrete pumping plant, and walls of our No. 2 concentrating plant, and under similar weather conditions, and we gave the concrete no protection. The walls in one of these buildings, the briquetting building, are 23 ft. high, 20 ft. between steel columns, 9 in. thick, without any reinforcing. This work in 1912 represented the consumption of 1000 bbl. of cement in seven-to-one mixture. This practice, I believe, is different from the general method of making concrete in cold weather. It will be observed that we have gradually grown into this procedure, starting in a small way in 1909 and growing braver until in 1912 we put in a very large amount. There has not been a single instance where the concrete has failed. The method we followed in putting in the concrete was the following:

The sand, rock and water were all heated and put into the forms before cooling and allowed to freeze without any protection except that given by the boards inclosing the concrete. Of course the unfinished surface which we left at the end of a shift was protected from freezing so that work could be resumed on it the next morning. No doubt at times this surface froze, and yet it showed no unfavorable results. The one requirement in freezing concrete we have found is that the concrete must not thaw out quicker than about four weeks, and that condition is met here in this climate during December, January, February and March. February really is the safest month of the year to undertake work of this kind. The boards on the forms protect the frozen concrete sufficiently so that the sun does not melt it on any of the bright days. Concrete thus made is, I venture, equal and in every respect similar to the concrete made in the ideal months of summer, and there is absolutely no peeling off, as is evidenced by the high walls at our No. 2 plant which show the saw marks of the boards of the forms.

I offer as an explanation of this, that the chemical action of cement must progress at this temperature and that the progression of the chemical action takes the frozen water in the mixture for its progression, so that when the weather becomes warm such that the water in the concrete would have melted, that water is all taken up in the chemical action, and there is no expansion or breaking up of the concrete due to the thawing.

My conclusion is that if concrete, immediately upon being placed in the forms, is frozen and remains frozen for four weeks, the chemical action has then completely taken place and thawing does not in any way affect it.

FRED A. JORDAN.

Sellwood, Ont., Mar. 10, 1913.

Simple Feed Water Heater

In my article under the above caption in the JOURNAL of Feb. 8, 1913, p. 327, a line was dropped out, thereby changing the entire sense of the paragraph. The paragraph should read as follows:

> The objection to an open heater is the danger of oil passing into the boiler with the feed water. As is generally known, oil in the exhaust steam after condensation exists in two forms, one of which rises readily to the surface while the other remains in fine suspension or in the form of an emulsion. The latter is often the source of annoyance in open feed-water heaters, especially when a poor grade of lubricating oil is used. On the other hand an open feed-water heater utilizes all the water from the condensed steam, which having been distilled or vaporized contains no mineral or vegetable matter to cause the formation of scale. This advantage is lost when using a closed heater and for that reason, unless water is plentiful and fairly pure, the open heater is to be preferred.

ALVIN R. KENNER.

Guazapares, Chihuahua, Mex., Feb. 24, 1913.

Fluidity of Gold Amalgam

I wish to ascertain how much gold mercury will absorb without losing its fluid state. I am unable to establish an answer to this question and would appreciate your assistance to that end.

C. F. CROPSEY.

Chicago, Ill., Mar. 8, 1913.

[Mercury-gold amalgam containing 90% mercury is fluid. With 87½% mercury, it is pasty and does not run, while with 85%, the amalgam is hard and crystalline.—EDITOR.]

Zinc Mining in New York

P. B. McDonald's account of "Zinc Mining in New York," in the issue of the JOURNAL of Feb. 15, 1913, p. 362, is in the main both accurate and concise. However, as manager of the Northern Ore Co.'s property, I do not agree with his theory of a "bedded vein" but believe the ore is secondary. There has been some filling of pre-existing cavities; a considerable amount of replacement accompanied by metamorphism and folding of the strata. Talcville is southwest of the Zinc mine, in Edwards, not northwest as Mr. McDonald states it to be.

F. J. GRUGAN.

Edwards, N. Y., Feb. 26, 1913.

EDITORIALS

The Smelting Company's Report

The report of the American Smelting & Refining Co. for 1912 is even less instructive than its predecessors, and not much of anything was to be said in praise of them. While most public companies are improving in the nature of their communications to their shareholders, the Smelting Company is reverting to archaic practices if its fourteenth annual report is to be taken as indicative. In a 12-page pamphlet we have one title-page, three pages of officers, four pages of remarks by Daniel Guggenheim "to the stockholders," one page of communication by a firm of public accountants certifying that the accounts are all right, two pages of balance sheet, and one page of income and profit and loss. We hope that the several thousand stockholders have a sense of humor.

The President's report informs them that the business of the company has been gratifying, notwithstanding the unfortunate political disturbances in Mexico, and recites some of the figures of the three pages of tables. His longest section is devoted to the praiseworthy pension system of the company, which is, no doubt, a subject that can be dwelled upon safely without betraying anything of the features of real interest in the company's business.

Turning to the income account, it appears that the smelting and refining plants earned $12,568,835 gross, an increase of $468,074 over the previous year, notwithstanding that $502,727 more was spent for repairs and renewals. The company's mines earned $3,113,105, an increase of $1,112,918. Other income was $1,077,559, an increase of $66,382. Administration and general expense, including amortization, amounted to $5,679,824, leaving net income of $11,079,676, which was $508,173 more than in 1911, notwithstanding several large items of expense which do not appear in the accounts for 1911. The appropriation for amortization of plants in 1912 was $3,013,543, which looks something like what it ought to be and renders the allowances of a few years ago on this account seem rather feeble. The investment account, representing largely the holding of stock in the Federal Mining & Smelting Co., has been written down again by a round sum and will, no doubt, be extinguished in a few years if the process be kept up. This, of course, is bookkeeping of the right kind.

A surprising feature of the report is the great increase in the income from the company's mines, which are largely in Mexico. Its largest American mining interest is the Federal lead property, in Missouri. The price for lead in 1912 did not average high by any means. The Western Mining Co. (of Leadville, Colo.,) appears to have paid dividends, part of which were "applied toward reduction of the book value of its stock instead of being credited to gross income." Amid such vagaries we become dizzy and unable to analyze any more.

However, we get the impression that the Smelting Company is rich and once more had a very prosperous year, which is encouraging to its stockholders, but if we were among them we should like to know something more about the sources of our income and the list and condition of our property.

Platinum in British Columbia

Some time ago there was much talk in the newspapers about an alleged discovery of platinum in certain dikes near Nelson, B. C., by A. Gordon French, and some technical newspapers took it rather seriously. There was something of a stampede to the locality, not a very big one, and some disappointment. In various ways the matter was brought to the attention of the British Columbia government and Mr. Robertson, the provincial mineralogist was instructed to investigate. He took a series of samples of the rocks supposed to be platiniferous and dividing them carefully, submitted them to seven assayers supposed to be most expert in the assay of platinum. These were: Johnson, Matthey & Co., of London; Ledoux & Co., of New York; F. P. Dewey, of Washington; the S. S. White Dental Manufacturing Co., of New York; the Department of Mines, Ottawa; the British Columbia Government laboratory; and the Consolidated Mining & Smelting Co., of Canada

Speaking from our own experience we may say that the assay for platinum is outside the ken of the average assayer; and that at least four of the assayers consulted by Mr. Robertson are expert in the assay for this metal; indeed, we rate them as very high authorities.

Each of the seven assayers consulted reported no platinum present in the samples, except the S. S. White Dental Co. That concern is an important refiner of platinum and the inference is drawn that the sample submitted to it was unconsciously salted from its refinery.

Considering the evidence submitted by Mr. Robertson we agree with him that the supposed discovery of platinum in British Columbia is not substantiated. Mr. French once gave to us in person his version of the matter. We are disposed to consider him sincere in his beliefs, but undoubtedly mistaken.

Economical Hoisting

Mr. Pauly, in this issue, replies to an article by Mr. Nordberg in the JOURNAL of May 18, 1912, and vigorously upholds the case of the electric hoist as against the hoist with air-actuated engines. The very earnestness of this discussion as to the relative merits of the two types is a healthy sign that the deficiencies of the old steam hoists are well appreciated. In mountain camps, off the railroad, the cost of a boiler horsepower-year will vary from $150 to $300 or even more, depending upon a multiplicity of details, even on reasonably continuous service, such as for pumps, mills and compressors, while for the ordinary steam hoist, the intermittent character of its work greatly increases this cost. If electric power can be purchased at any reasonable price and if the

property has any life in prospect, it is a rare case in which it does not pay to employ electric power for hoisting in some form or other, not meaning by this that the direct application of electricity to the hoist-motor is necessarily the best thing to do.

If such a change is being considered and tests on the old steam plant are undertaken to determine its advisability, care should be exercised to make these tests fair. Operating conditions should not be modified, nor the plant overhauled and tuned up, or the results will be misleading. There have been boiler tests conducted for such purposes that gave only half the fuel consumption obtained in actual operation, and a consequently false idea of the saving possible. In estimating for any such installation, the whole operating cycle, including loading and unloading time, unproductive work, and long and short stops, must be considered, and especially the fact that for a low load-factor the efficiency of the hoist decreases greatly; in other words, the boilers continue to consume coal, even when the hoist is idle.

These considerations apply to any contemplated installation of electric power for hoisting, whether it be used directly or through the medium of an air compressor. It is urged, however, for the direct electric hoist, that its original efficiency shows almost no dimunition with continued use.

It should be noted that the discussion between Mr. Pauly and Mr. Nordberg is principally in regard to the best method of applying to hoisting problems electric power purchased or generated outside, Mr. Nordberg's installation at the Anaconda being based on electrically generated compressed air. The question of which system to select is still an open one and no doubt, as Mr. Pauly states, every case must be studied in the light of its own peculiar conditions before the right answer can be given.

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Wanted: A Mines Building

The last Congress took an important step in providing for the long desired building for the Geological Survey and the Bureau of Mines, at Washington. No doubt such a building will be erected in the not very distant future. Congress contemplates housing the Survey, the Bureau of Mines, the Reclamation Service and the Indian Office, all together. We are sorry that Congress did not see fit to honor the mining industry by a special mines building. Surely the magnitude and importance of the industry warrant that. There is no particular association between mining and the reclamation of land for agricultural purposes, and much less between mining and Indians, though to be sure there was an intimate relationship in Arizona in the '70s and '80s. Why does not the reclamation service belong to the agricultural department anyway? The fact is that the Washington bureaus are a hodge-podge, the director of each grasping for all he can get and seeking always to make a desk grow where no desk e'er grew before. The mining industry would be helped if all the Washington operations directly concerned with it could be collected under one responsible head, say an Assistant Secretary of the Department of the Interior. We hope the present administration will consider this and we will suggest that when it does so it would do well to consult an advisory commission of engineers in practice.

Copper Production

Much has been said about the unreliability of the refinery statistics as an index of copper production from month to month, experience having shown them to rise and fall with surprising irregularity, going up when they ought to go down and *vice versa,* because of conditions that are inherent in the business. The real guide to the changes in the rate of copper production is the mine and smelter figures that are published monthly in the JOURNAL. Although it is impossible to give complete returns, month by month, a relatively small portion of the production having to be estimated; and although they cannot be given on the uniform basis of either mine or smelter returns; experience shows that they run closely to annual total. We have made the following comparison for 1912:

U. S. COPPER PRODUCTION, 1912

Month	(Mines (*a*)	Smelters (*b*)	Refiners
January	98,896,026	139,027,356	119,337,753
February	98,476,798	127,885,749	116,035,809
March	104,151,585	136,407,674	125,694,601
April	99,450,565	135,643,551	125,464,644
May	105,830,984	138,077,729	126,737,836
June	98,275,892	130,942,120	122,315,240
July	105,991,777	138,326,904	137,161,129
August	110,287,405	142,393,190	145,628,521
September	103,192,817	135,484,378	140,089,819
October	95,589,091	135,019,240	145,405,453
November	101,309,798	132,256,625	134,695,400
December	103,005,194	142,151,943	143,354,042
Totals	1,224,457,932	1,633,616,459	1,581,920,247

(*a*) Based partly on copper content of ore and partly on pig copper product. (*b*) Based as explained in previous note; includes copper content of imported ore and pig copper.

In our New Year number we reported the production of American mines as 1,242,836,024 lb., and of American smelters as 1,654,827,041 lb., these figures in each case being based on the pig copper reported by the smelters. These figures exceeded the totals of our monthly figures by about 18,000,000 and 20,000,000 lb., respectively, showing that we underestimated the non-reporting mines by a little and probably overestimated the smelting loss of some of the reporting mines which state their ore content rather than the actual product thereof.

The mine and smelter figures show that output was made at a pretty uniform rate during 1912, no marked tendency toward an increase being exhibited in spite of the high price prevailing for the metal. The average monthly production was about 135,000,000 lb., if we allow for the copper going into bluestone, etc. During January and February of 1913, it appears to have been running at about the same rate. In the long run the refinery production will, of course, have to average the same, although in single months it may vary as much as 10,000,000 lb., plus or minus.

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A Mountain Out of a Molehill

This issue of the JOURNAL contains an abstract of an article describing the surveys made for the Mount Royal tunnel. The description is interesting for the ingenuity and extreme care exhibited in the work. It is still more interesting as showing how a mining engineer would not do it. There is something mysterious about things underground that terrifies the civil engineer to a rather laughable degree. A 3½-mile connection in level country would seem to present few difficulties; yet more elaborate methods of traversing than those adopted would be hard to devise, and just why the ground was traversed, rather than triangulated is not clear.

To the engineer of a large, well-managed mine, who

so conducts his work that he can start a connection anywhere, any time, the painstaking devices and the endless checks employed on this job would come as a bewildering revelation. What is to him part of the day's work is here made almost a subject of special research. Accurate connections are part of the mining surveyor's religion. We recall the North Star shaft and Central raise connection, involving 3000 ft. of incline shaft, nearly a mile of surface traverse, double-wire plumbing down 1600 ft. of vertical shaft and 1000 ft. of incline raising, where the work took several years, covered several changes of surveyors and finally holed through to half an inch, we believe; and more lately there have been in Bisbee and in other camps examples of timbered shafts raised from several levels and holing through, to give practically perfect alignment of the timbers. Such results are nothing out of the ordinary, yet they are got with a minimum of effort by dint of care and common sense and familiarity with underground conditions.

It is the novelty of such undertakings that seems to stagger our friends and leads to absurd precautions. Why, for instance, is it necessary to run the exact line of the tunnel over the hill? There are simpler ways of locating the intermediate shaft. We have heard a mining surveyor interrogated by a railroad engineer—and a good one, too—as to whether mining underground work was not laid out on the surface first. Fancy a hillside covered with the outlines of all the mine workings!

Any lowering of surveying standards cannot be tolerated, it will be urged. But engineering is the adoption of the means to the end and the methods here described are elaborate far beyond the requirements of the case. Still an engineer may be forgiven for getting somewhat panic-stricken when the successful completion of a several-million-dollar tunnel hinges on his work.

BY THE WAY

The copper production of the Ashio mines, Japan, in 1912, was about 20,000 tons. A large increase in production is expected from these mines in 1913.

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The Inspiration Consolidated Copper Co. is making experiments with the flotation process for the concentration of its ore and is obtaining encouraging results.

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A Colorado Springs dispatch of Mar. 20 announces the election of Miss Olive L. Granfield, of Mount Vernon, N. Y., as president of the Cripple Creek Gold Mining Co., C. K. & N., succeeding W. H. Davis. This is said to be the first time in Colorado that a woman has been put at the head of a company owning a real mine. Miss Granfield inherited a large block of C. K. & N. stock from her father, Horace Granfield, the founder of the company, who was killed in an automobile accident in Colorado a few years ago. Miss Granfield spent the winter in California and was on her way home when she was asked to attend the stockholder's meeting and was prevailed upon to accept the presidency. The C. K. & N. company is the defendant in an apex suit, involving over $1,000,000, the complainant being the El Paso company. As Miss Granfield is reported to be "handsome and in the early twenties," it is hoped, for the ends of justice, that the president of the defendant company will not be called into court.

Congressman William Kent, of California, is the originator of the attempt to legislate the gold dredges out of commission, writes a California correspondent. Mr. Kent is so enthusiastic in his belief in the necessity for the conservation of the land for the benefit of the agricultural posterity that he once wrote a poem, of which the following verse is the conclusion:

> Our duty that our little plot is tilled
> So those that follow find in mellow land
> A world where more men clearer see Thy face,
> Because we lived and toiled.

After reading the verse, the Sacramento Chamber of Commerce rescinded its recent indorsement of the dredging bill by a vote of 8 to 5. It is believed the five who voted against rescinding were still deeply impressed with Mr. Kent's poetic sentiment.

❖

The credit for introducing high explosives in the Lake Superior mining district, according to A. H. Meuche, in a publication of the Michigan Geological Survey, belongs to John Mabbs, an agent of the Isle Royale copper mine. The story of the affair is told by Graham Pope as follows: "In 1870, I think it was, but possibly in 1869, Mr. Mabbs bought in New York 4000 lb. of nitroglycerin 'oil' which was contained in 100 tin cans. The 'oil' was 13 times stronger than the black powder then in use. About this time a number of terrible accidents occurred from the use of this oil, and a great outcry rose against it, but after much trouble he persuaded one of the Pennsylvania coal-carrying roads to transport it. Unfortunately news of its shipment was sent forward when a mob assembled and stopped its passage. It was then sent back 100 miles, transferred to another road and finally reached Cleveland. Mr. Mabbs, fearing arrest for violating the city ordinances, was anxious enough to get it away, but could get no steamboat to take it, and as few sailing vessels were bound for Portage Lake it was only after great trouble he was able to persuade a master to take it to a powder magazine above Hancock. The Hancock authorities, having heard of its presence promptly ordered it out of the place and it was removed to an old stope in the mine. A few days after this, orders came from the East to close the mine, and he had time only for a few blasts. Nothing disheartened, he persuaded the Huron mine agent to allow its use there with the understanding that he was to do the blasting. He put up a little magazine and under cover of darkness put there one can only of oil, containing 40 lb. The miners became so excited and furious that they stopped work at the mine. A great mob gathered and preparations were made to ride the enterprising agent out of the place on a rail, but they did not get him. That night they blew up the magazine, thinking all the stock was there. It having leaked out that there was more of it, searching parties were formed to get it. It was moved half a dozen times just in time to save it, and finally it was hidden in the woods just east of where the Mining School now stands. Mr. Mabbs and his brother had in each case handled the oil themselves. They finally loaded it into a yawl and started with it for Marquette, which place they reached in safety after a narrow escape from being lost in a storm on the lake. They got permission to try it on some of the 'hard heads' in the iron mines, and were so successful that they had no trouble in closing out their stock, and the use of this material was continued there to a limited extent until the present method of marketing it was adopted."

PERSONALS

J P. Hutchins is in St. Petersburg, Russia.

George B. Atkinson has left Atbasan and returned to London.

Ross Browne Hoffmann has returned to London from East Siberia.

W. E. Selkirk has returned to London from Ekaterinburg, Russia.

Harold C. E. Spence arrived in New York last week from Montreal, and sailed Mar. 20 for London.

B. M. Snyder, of Los Angeles, Calif., is making examinations in Pima and in Maricopa counties in Arizona.

Robert Linton has just completed an examination of iron-ore deposits in east Texas, and is now in Pittsburgh.

W. E. Thorne has gone to the Lena River region of Siberia where he will be engaged in examination work until October.

August A. Hoffmann has returned to Stockholm, Sweden, from the Ural Mountains in Russia, where he has been engaged in inspecting copper mines and smelters.

E. J. Franklin, superintendent of power for the Ray Consolidated, is at the Chino copper properties, at Hurley, N. M., to do some special work on the power plant.

S. H. Brockunier, superintendent of the Pennsylvania Gold Mining Co., Westville, Calif., is recovering from a prolonged attack of pneumonia and will soon be able to resume his duties at the mine.

Pope Yeatman sailed on Mar. 19, for South America, where he will visit the properties of the Braden Copper Co., and of the Chile Exploration Co. at Chuquicamata. He will return to New York in July.

Ira N. Hollis, for a number of years professor of engineering in Harvard University, has been chosen president of the Worcester Polytechnic Institute at Worcester, Mass., and will take charge immediately.

George McDuffie, superintendent of the ore mines of the Woodward Iron Co., at Bessemer, Ala., has resigned and is succeeded by Ben E. Purser, of Dolomite, who is made general superintendent of the coal and ore mine division.

A. A. Hassan has gone to Nova Scotia to investigate and report on the properties of the Boston & Goldenville Gold Mining Co. He will be engaged there about six weeks, his address being Moose Head, Halifax County, Nova Scotia.

William A. Carlyle has resigned the professorship of metallurgy at the Royal School of Mines, London. He has entered into partnership with John F. Allan, and they have established offices as consulting engineers at No. 62 London Wall, E. C., London, England.

B. F. Fackenthal, Jr., has resigned his position as president and general manager of the Thomas Iron Co., after 20 years' service. William H. Hulick has resigned as vice-president. Edwin Thomas, of Catasauqua, Penn., has been chosen vice-president and general manager. The presidency remains vacant.

Kosaku Asano, chief metallurgical engineer of the Ashio copper mines in Japan, has been making a tour among the mines and metallurgical works of the United States, and is now about ready to return to Japan. M. Otagawa, who is well known among American mining and metallurgical people by reason of his long sojourn in the United States, is now general manager of the Ashio copper mines in Japan.

OBITUARY

Commerzienrath Louis Feist, senior partner of the firm of Beer, Sondheimer & Co., died at Frankfurt-am-Main, Germany, on Mar. 10, aged about 54 years.

Thomas H. Jewell, superintendent of rolling mills of the Wisconsin Steel Co., died Mar. 4, at his residence in Chicago, after a short illness, aged 71 years. He was born in England, but came to this country when a boy and secured work in the rolling mills at Troy, N. Y. From Troy he went to Cleveland, then to Michigan and later to Chicago. He was present at the making of the first bessemer steel, on a commercial basis, in America, in the fall of 1864, at Wyandotte, Mich. He was superintendent of the rolling mills of the Wyandotte plant for several years, going from there to Chicago, where he took charge of mills controlled by the company that also operated at Wyandotte. He was superintendent of the rail mill of the Union works when it was producing record tonnages. His term of service with the different companies in the Chicago district which later formed the Illinois Steel Co., covered a period of 40 years. He left the Illinois Steel Co. to go with the Wisconsin Steel Co., at South Chicago, and at the time of his death had been for 12 years superintendent of its works.

SOCIETIES

Old Freibergers in America—A meeting and dinner was held at the Hofbräu-Hans, New York, on Mar. 25, about 14 members attending. Plans for increasing the interest in the organization were discussed.

American Institute of Mining Engineers—At the meeting of the New York section, held Mar. 21, the address of the evening was delivered by George S. Rice, chief mining engineer of the U. S. Bureau of Mines, on European mining practice, noting especially the hydraulic-filling systems in use. H. M. Warren, electrical engineer of the Delaware, Lackawanna & Western R.R. Co., added some remarks on European underground electrical practice. Kosaku Asano, chief metallurgist of the Ashio Copper Co., discussed briefly the new smelting plant of that company and especially the plans for disposing of the furnace gases and fumes. The president of the Institute, Charles F. Rand, announced that the great success of the Iron & Steel Committee had led to the determination to form a similar committee of the Institute, which should devote its attention to economic geology.

INDUSTRIAL NEWS

G. D. Warren, 876 Galapago St., Denver, Colo., has shipped a 400-cu.ft. hydraulic air compressor to the Electra Gold Mining & Milling Co., in Eagle County, Colorado.

The Power & Mining Machinery Co. is to open an office at 153 Queen Victoria St., London, E. C., England. A. W. Catlin, formerly of the Allis-Chalmers Co.'s London office, has been appointed manager.

Fairbanks, Morse & Co., Chicago, Ill., is marketing a little device, "The Current-o-Scope," which shows in a simple manner how the so called revolving field is produced by the action of alternating currents, in a three-phase alternating-current induction motor.

J. W. White, engineering salesman for the Jeffrey Manufacturing Co., until recently at Athens, Ohio, has been transferred to Duluth, Minn. Mr. White will look after the sales in eastern Minnesota, northern Wisconsin, and the entire upper peninsula of Michigan. His headquarters will be at 1905 East Superior St., Duluth, Minn.

The American Brass Co. has amalgamated all of its subsidiary corporations and wound up their individual existence, this including the Ansonia Brass & Copper Co., of Ansonia, the Coe Brass Co. of Torrington and Ansonia, and Holmes, Booth & Hayden Co., the Benedict & Burnham Manufacturing Co., the Waterbury Brass Co., and the River Co., of Waterbury.

Werf Conrad, Ltd., has just dispatched the first bucket dredge to work on Nigerian tin deposits. This dredge, built under the direction of Lake & Currie, is of 4-cu.ft., close-connected type. Its dimensions are 82 ft. by 33 ft. by 4 ft. 5 in. at sides; draft about 2 ft. 9 in. The hull of the dredge is of steel, and is constructed as two pontoons with well for bucket ladder.

According to a Pittsburgh dispatch in the "Journal of Commerce," there is almost a famine in small-dimension lap-weld steel line pipe on account of the activity in the oil fields. Two-inch and 3-in. lapweld are all but out of the market, and the demand continues extremely heavy from the oil operators. Up to 6-in. pipe the mills are in better shape for deliveries for the time being. Inquiries are increasing for line pipe, but most of the business in sight is for small lots of from one to 10 miles, but which in the aggregate represents a very substantial tonnage. The butt-weld pipe trade is still a little out of season, but there are early indications that this product will be very active during the early spring, as no jobber appears to have any considerable stock on hand.

EDITORIAL CORRESPONDENCE

SAN FRANCISCO—MAR. 19

Complaints against the Mammoth Smeltery by the farmers of Shasta County have been renewed. The protective association asked the board of supervisors for an appropriation of $2000 to aid it in legal action, and that the district attorney be designated by the board as its legal representative. District Attorney Chenowith stated that he could act officially only when the complainants have established the fact that a nuisance was being maintained by the operation of the smeltery. The farmers want the district attorney to establish the fact. They seem to have exhausted their voluntary resources when they closed the Balaklala. They claim there is the same authority for assistance from the county as for like assistance rendered by the supervisors of Solano County in behalf of the farmers who complained of the Selby smeltery. If the result in Shasta County could be assured to be the same as in Solano County, it would be the best solution of the smoke problem, and it would end the insistent complaining against the smelting industry in the Shasta district. The selection by the supervisors of Solano County of three competent scientific investigators to decide about future complaints against the Selby smeltery has put the farmers in a position where they will have to abide by the decisions of the experts. There has been talk of a revival of the legislation against the smelters that was undertaken two years ago at Sacramento; but it is apparently nothing more than talk.

That the Fuel-Oil Industry Should Be a Public Utility is maintained by a few oil producers, who are endeavoring to influence legislation to have this status established. Their proposition affects the production, transportation and distribution of petroleum used for fuel, and places the industry on the same plane as electric, irrigation-water, canal, gas, and domestic-water systems. The proponents of the legislation desire to have the price of oil as well as the transportation rates fixed by statute. They have concluded that the oil business is in a deplorable condition, and it may be inferred that they fear that the state will drop into the same deplorable condition unless it rescues itself by rescuing the oil industry from the railroads and the large marketing concerns. A few years ago the petroleum industry was said to be at the mercy of the Standard Oil Co. and demands were made for a dissolution of the trust. The trust was dissolved. The oil business is still in the dumps. There has been much foolish and vicious legislation introduced during the regime of the present administration, but this is the first that has the merit of not being vicious.

DENVER—MAR. 21

A Gold Strike Has Been Made on Cat Creek, at or near the line of Rio Grande and Conejos Counties. State Mine Inspector Henehan will visit the district. The discovery was made in what is known as the Platteville-Summitville-Gilmore district, and is commonly spoken of as the Gilmore discovery.

Reports from the Eagle District continue to be of an encouraging nature. It is said that many men are going to Eagle County, among them many of considerable experience in new mine camps. One claim was recently optioned, according to reports, for $60,000; $6000 down. The snow is disappearing rapidly and as quickly as the ground is exposed and weather permits, the ground is opened by trenches, prospect pits and small shafts.

The Cyanide Plant at Ophir is Operating at full capacity, 150 tons per day, treating ore from the mines of the Ophir Gold Mines, Milling & Power Co., including the Suffolk and other properties on Silver Mountain, which were consolidated upon the formation of the company. These mines were noted producers in the early days. Now that the old stamp mill with facilities for recovering the gold only by amalgamation, has been remodeled and a modern plant with cyanide annex has been completed and put into commission, much ore is available that can be mined and treated at a good profit. Gold bullion is now being shipped regularly.

The Strike Recently Made at Camp Bird seems to be of greater importance than was at first apparent. The high-grade ore cut on the sixth level is richer than any that has been found in the same shoot. Drifting is now under way in both directions on the vein. The extent of the oreshoot on the sixth level has not been determined. The sinking of a shaft to establish a seventh level will be started in a short time. When Camp Bird was examined in 1909, it was concluded that new ore would be discovered in lateral rather than in deeper developments; following this a strike of $30 to $40 ore was made in the fifth level west. Last year's strike at the fourth level prolonged the life of the mine and kept the mill running at 50% capacity. The latest strike is 400 ft. deeper, or 900 ft. from the surface.

BUTTE—MAR. 19

A Flow of Oil Was Encountered at a depth of 50 ft. while drilling a well a few hundred yards from the business district of Clyde Park, a few miles north of Livingston, in Park County. Considerable excitement was caused by the find. Prices of land about the town at once began to climb, and many transfers of real estate were recorded within a few hours. Preparations are being made to investigate the extent and quality of the oil.

Oil and gas claims were filed in the office of the county recorder at Billings, Mar. 13, to the extent of 39 claims, comprising 4800 acres in the district known as the Bitter Creek field, situated south of Billings, a short distance from the south bank of the Yellowstone River. It is not known whether development work will be started at once or not.

Electrification of the Butte, Anaconda & Pacific R.R. at the Anaconda end of the line is progressing rapidly and it is expected that it will be ready for operation within six weeks. The Anaconda yards are wired and the work in the East Anaconda yards and on the smeltery lines is nearing completion. Two of the electric engines which were ordered some time ago from the General Electric Co., have been completed, tested at the works, and found satisfactory. Direct current at 2400 volts will be used in the operation of these locomotives. A high voltage is used because of the heavy loads that will be handled and the steep grades that prevail on portions of this line. The machinery used in furnishing the power for the operation of the locomotives has been installed in the newly erected substations near the smeltery, and the plant is in readiness to furnish the power as soon as the engines arrive. As soon as the local work of the electrification of the Anaconda end of the line is completed, the main line will be electrified about half way to Butte, as far as Gregson Springs, which will take only a short time, as everything is in readiness for the stringing of the trolley wires. It is rather indefinite yet as to how soon it will be possible to complete the work to Butte, as the Milwaukee railroad is engaged in widening the cañon at Durant, one mile east of Gregson Springs for the construction of its line through the narrow rocky gorge, the only outlet from Silver Bow cañon into Deer Lodge Valley. Until this work has been completed, which may not be before May or June, the Butte, Anaconda & Pacific R.R. will not be able to erect poles and wires in the cañon.

SALT LAKE CITY—MAR. 20

The Bingham Mines Co. Has Sold Its Smeltery and entire holdings at Midvale, Utah. The smeltery was built in 1901 at an approximate cost of $1,000,000, and improvements were made from time to time, until it was closed in 1907 as a result of the smoke agitation. The Utah Junk Co. was the purchaser, and the dismantling and sale of machinery will be under the direction of N. Rosenblatt & Sons Co. There are about 1600 tons of structural steel, a sampling plant, two electric cranes, boilers, stacks and blowers, roasters, furnaces and copper smelting equipment. Beside this there is considerable electrical machinery.

Opposition to Lead-Tariff Reduction will be made by Utah lead producers. This was decided at a meeting held Mar. 17. The Utah producers propose to ask the producers of lead and zinc in all of the intermountain states and in Missouri to cooperate with them in the collection of statistics, etc., regarding the industry, so that the Ways and Means Committee, the Finance Committee, and the Democratic Congress as a whole will have full and reliable data upon which to base their actions regarding lead and zinc. A report was read by George W. Riter, recently returned from Washington, where he appeared in behalf of Utah lead producers before the Ways and Means Committee of the House. Mr. Riter gave

a general view of the situation and called attention to the fact that while the former administration did not interfere with the tariff on lead for political reasons, the present administration has no obligations political or otherwise for favoring the lead producing states. Mr. Riter recommended that the lead and zinc producers of the Western states unite in at once preparing a brief of their case containing only the most vital facts and figures for the information of the Ways and Means Committee of the House and the Finance Committee of the Senate, which will make recommendations for tariff legislation. Duncan MacVichie, chairman of the meeting, moved that a committee be appointed to make the necessary arrangements for gathering statistics covering the production of lead and zinc, and that the committee invite all lead- and zinc-producing states to coöperate in the matter, so that the producers may be able to present their case in good form at Washington. The following committee was appointed: Duncan MacVichie, George W. Lambourne, George W. Riter, Thomas Kearns, Ernest Bamberger, George H. Dern, W. Lester Mangum, C. E. Allen, J. M. Hayes and I. Pett.

NEGAUNEE—MAR. 19

The Gogebic Range Shipments for 1912 show one new shipper, the Plummer mine of the Oliver Iron Mining Co., which forwarded 47,578 tons. The Newport mine of Ferdinand Schlessinger increased to 966,357 tons, about its normal production from 560,760 tons in 1911. The Norrie group of the Oliver company increased to 1,500,732 from 883,910 tons in 1911. Other large gains were by Oglebay, Norton & Co., which increased its Montreal mine shipments to 247,772 from 153,122 tons, its Castile mine shipments to 136,703 from 23,598 tons, and its Ottawa mine shipments to 111,396 from 44,643 tons; by Corrigan, McKinney & Co. which increased its Colby mine shipments to 245,195 from 41,630 tons, and its Ironton mine shipments to 173,135 from 63,359 tons; by Pickands, Mather & Co. which increased its Cary mine shipments to 308,292 from 120,017 tons, its Brotherton mine shipments to 148,930 from 65,105 tons, and its Sunday Lake mine shipments to 155,485 from 56,096 tons. The entire range gained from 2,603,318 tons in 1911 to 4,996,498 tons in 1912, an increase of 2,393,180 tons, nearly doubling the 1911 figures.

The U. S. Steel Corporation in 1912 shipped 23,845,363 tons of iron ore from the Lake Superior district out of a total of 48,211,778 tons, being 49.46%, as compared to 52.7% in 1911, 49.86% in 1910, 50.36% in 1909, 56% in 1908 and also in 1907, and 53% in 1906.

The Operations of the Oliver Iron Mining Co., the Lake Superior mining department of the U. S. Steel Corporation, on the Gogebic range, are confined to the following mines: Tilden at Bessemer, Pabst, Aurora, Norrie, Davis, Geneva and Puritan at Ironwood, and the Atlantic at Hurley These mines are in general large, deep, and producers of high-grade ore. On the Marquette range the company is operating with reduced forces and several mines are closed down, including Sec. 21 and Champion. In this district the company owns the fee or mineral right on much of its holdings, and can afford to delay mining, while attention is directed to leased properties in other districts. The active mines on the Marquette range are the old Lake Superior Hard Ore and Hematite mines, Sec. 16 at Ishpeming, and the Blue and Prince of Wales mines of the Queen group at Negaunee.

In the Iron River and Crystal Falls districts the Oliver Iron Mining Co. has never been active in acquiring properties as the ores are generally non-Bessemer and relatively low grade; one mine in each district is being operated. On the Old Menominee range, the company is only moderately active, but is doing considerable repairing and equipping especially in regard to the Chapin mine at Iron Mountain which is estimated to contain 9,000,000 tons of high-grade ore after a record of 18,000,000 tons shipped in the past. At this mine the Hamilton shaft is to be lined with concrete for 1425 ft., replacing wood. Four electric centrifugal pumps will be installed, two on the 16th level and two on the 12th level, pumping to surface in two lifts. The Riedler pump in the Hamilton shaft and the big Cornish pump in the new shaft to the west will also be used. The Chapin has always been a wet mine and has given trouble from sudden rushes of water. Compressed air has formerly been furnished to the Chapin through an air line four miles long from Quinnesec Falls on the Menominee River. It is now proposed to erect a concrete hydro-electric plant at the falls to contain two 2800-hp. Allis-Chalmers turbines designed for 56-ft. head. Each turbine will be connected to a 1875-kw., three-phase, 60-cycle generator. Transformers will step the voltage to 13,200 for transmission. The transmission will be a double system of three wires each. At the mine the voltage will be reduced to 2300. Electrical underground tramming will then be adopted and other electrical machinery will be installed. An auxiliary steam plant for use in emergency will be built at the Hamilton shaft and a 2250-kw. steam turbine will be installed.

JOPLIN, MO.—MAR. 21

Operations Have Gradually Been Resumed at the mines which closed down during the early part of the month, and production has been increased nearly 2000 tons over the period of restriction; 5000 tons of concentrate, mostly from Webb City sheet ground, was recently disposed of. A large tonnage of silicate ore has been shipped recently, the greater part of which was reserved stock at the Granby camp. Demands for higher wages have been made by the miners in several camps, but no strike of serious nature is apprehended.

DEADWOOD, S. D.—MAR. 21

Wasp No. 2 Profits in 1912 were $115,000, according to the annual report. Of this profit $85,000 was paid in dividends and the balance was carried to surplus. The ore treated, amounting to 158,840 tons, yielded $308,175, or $1.94 per ton. Mining costs were $90,077, or $0.567 per ton; and milling costs totaled $99,513, or $0.627 per ton. General expenses were $6377, or $0.04 per ton, bringing the total cost to $1.234 per ton. In addition to the profits from the mine, rents, coal sales, etc., gave a small return. The showing is remarkable, when the grade of ore, and the fact that it is cyanided, is considered. During 1912 the mill lost 40 days' running time, being shut down on account of bad weather. The rest of the year it treated nearly 500 tons daily.

Milling Was Commenced at the Bismarck Mine Mar. 3 and the plant is gradually being brought up to full capacity, 300 tons daily. The property adjoins the Wasp No. 2, but differs from the Wasp in that the ore will be mined through glory holes. The mill is equipped with one elevator, with which single exception the ore moves through the mill by gravity. Mine ore is received in a 475-ton bin, from which it is drawn to a No. 5 K Gates crusher. A 24-in. belt conveyor carries this product to two No. 3 Gates crushers, where it is reduced to ¾-in. and elevated to a bin of 450 tons capacity. From this bin it is fed to two 15x36-in. Allis-Chalmers rolls, which operate in closed circuit with two shaker screens, set at an angle of 45°. The screen is heavy wire, with openings $\frac{3}{16}$ in. square. From the 475-ton bin into which this product drops it is drawn to conveyors, which charge the six leaching tanks, one of which is 30x12 ft., the others are 28x9 ft. Zinc shavings are used to precipitate the gold. The plant is driven by electricity, and a small boiler is used for heating.

TORONTO—MAR. 21

A Bill Making an Eight-hour Day Compulsory was introduced in the Ontario legislature Mar. 20, by Hon. W. H. Hearst, Minister of Lands, Forests and Mines. The bill applies to underground workers excepting those in iron mines. The measure is based on the recommendations contained in the report of Samuel Price, former mining commissioner, who was appointed to investigate conditions in Ontario mines. It provides that no workman shall remain or be allowed to remain underground for more than eight hours in any consecutive 24 hours. The recess for lunch is not to be included in the eight hours, and when the means of access to and from the place of work in the mine are declared by the inspector to be reasonable and satisfactory, the time is to be reckoned from the time of arrival until the time of leaving the place of work, otherwise the eight hours is to be reckoned from the time of leaving until the time of returning to the surface. The Saturday shift may work longer hours for the purpose of avoiding Sunday work, or changing shift at the end of the week, or giving any of the men a part holiday. The eight-hour day will not apply to shift bosses, pump men or persons engaged solely in surveying or measuring, nor in cases of emergency, where life or property is in imminent danger, or in cases of repair work, or in any mine where the number of men working in the shift does not exceed six. If the bill becomes a law it will come into effect Jan. 1, 1914. The proposed bill will affect about 4000 men, chiefly in the Cobalt and Sudbury districts.

PORCUPINE—MAR. 22

Strike conditions began to assume serious proportions during the last week or so, and it seems to be the impression among a number of the managers that the time has arrived when the government should step in and put an end to the disturbances. There have been several clashes between the union and nonunion men and in several instances men working at the mines have been badly beaten. The nonunion men have the upper hand, but the strikers are still aggressive, and the area is so large that it is difficult for a few provincial police to control the situation. Since the majority of the provincial police were withdrawn some time ago, outbreaks have been almost of daily occurrence. As a consequence, 15 officers have been sent back to maintain order.

THE MINING NEWS

ALASKA

RICH PLACERS ON THE TALKEETNA RIVER in the Matanuska district have caused a stampede from Knik, the nearest mine settlement.

A CONSIGNMENT OF GOLD TOTALING $44,600 reached Seattle Mar. 18, Nome contributing $8600, Fairbanks $19,000 and the Iditarod $17,000.

ALASKA-TREADWELL—In February, 65,912 tons of ore milled yielded bullion and concentrate estimated to be worth $155,055 or $2.37 per ton, the net profit amounting to $72,741.

Fairbanks District

CRITES & FELDMAN—A shipment of ore will be crushed in the Willis mill on Chatham Creek.

REXALL—Work has been discontinued on the rich stringer and the opening of the larger vein is underway.

HOMESTAKE—Development work will be done, but no ore will be stoped for the present. C. M. Nicholson, of Valdez, is superintendent.

RAINBOW—The crushing of 250 tons of ore from this mine was recently completed at the Chena mill. The first cleanup returned about $16 per ton.

SPALDING & RONAN—The milling operations have been confined to custom work for other lessees on the property of the Reliance Mining Co. The water supply has been found insufficient to keep the mill running a 24-hr. shift.

VERNAL AND RUBY—H. H. Ross and R. T. Blakely will develop these claims at the head of Dome Creek. A shaft is 73 ft. deep, from which some ore milling $50 per ton has been taken.

CHATHAM MINING CO.—The last two cleanups have been at the rate of about $20 per ton, which is more than sufficient to pay operating and development expenses. The ore reserve is constantly being increased. S. Scrafford, one of the owners, is in charge.

RONAN, COLE & KEEGAN—A boiler and hoist have been installed at the shaft and a headframe is being erected. It is the intention to sink on the largest of the three parallel veins and then to crosscut to the other two; 25 tons of ore crushed at the Spalding mill returned $40 per ton.

RELIANCE MINING CO.—The shaft on La Rose claim which C. F. McGillivray and Frank Fisher have under lease, is 60 ft. deep. The vein is 2½ to 3 ft. wide, but does not pan well except near the surface. The lessees plan to drift along the vein and to drive crosscuts to the two adjacent parallel veins that have been disclosed by surface trenching.

GIBBS, NARS & ANDERSON—Pending the installation of a pump, operations will be confined to that portion of the vein above the 100-ft. level. The drifts on the 60-ft. have been extended 75 ft. in each direction from the shaft. A raise has been put through to surface and some ore has been stoped. On the 100-ft. level, little has been accomplished beyond driving crosscuts to the vein. A shipment of 35 tons of ore taken chiefly from development when crushed at the Willis mill yielded 192 oz. of amalgam, probably worth about $7 per oz. Second-grade ore is on the dump awaiting cheaper milling.

TOLOVANA—No work is being done by this company although it is the intention to resume work in the shaft as soon as a suitable pump can be obtained. The ore near the bottom of the shaft is the best that has been found in the mine. This is said to be the only property in the Fairbanks district where the ore has consistently improved with depth. Lessees are opening the vein, discovered some time ago on the divide between Willow and Bedrock Creeks. In February 70 tons of ore crushed in the Tolovana mill yielded $1880 in gold, or $27 per ton.

ARIZONA

Cochise County

COMMONWEALTH EXTENSION—Work has been begun on the new double compartment shaft on the Arthur claim. A large force of men is now at work under the direction of L. Stallings.

Gila County

SOUTHWESTERN MIAMI—Drilling is progressing steadily; hole No. 4 is 755 ft. deep, No. 11 is 870 ft. and No. 14 is 500 ft. deep. All three holes are bottomed in schist.

KEYSTONE—The main drift, connecting the lower workings with the surface, is being retimbered and cleaned out. Special attention has recently been given to retimbering.

BLACK WARRIOR—Shipments are being made at the rate of about 100 tons of siliceous ore per day to the El Paso smeltery. Full scale operations have been resumed after the period of inclement weather in February.

NEW STATE—The shaft, in which high-grade lead ore containing molybdenum and vanadium was encountered last year, is reported to have been sunk on patented ground of the Continental group which is the property of the Old Dominion.

OLD DOMINION—Delayed shipments of steel have retarded the construction of the new units of the mill. At the Buckeye, one of the outlying properties which has made no underground connection with the Old Dominion workings, one shift of men is raising and drifting.

ARIZONA COMMERCIAL—The Copper Hill shaft has reached a point below the 900-ft. level and sinking is being continued. Development is being carried on by drifting on the 700- and the 800-ft. levels. Drifting on the 700-ft. level has not reached the boundary of the ore previously encountered.

GIBSON COPPER CO.—The output has been curtailed lately on account of lack of fuel. Oil burners are to be installed soon. The fuel used at present is wood from the Final mountains. It is reported that the high-tension power line that is being built from Roosevelt to Superior may be utilized by the Gibson.

MIAMI—Further development is being carried on by two churn drills and by diamond drilling. The site for the new lumber yard and warehouse, which is being constructed, necessitates a fill of 2000 cu.yd. J. Parke Channing is at the property on account of the illness of the general manager, B. Britton Gottsberger.

IRON CAP—Two strikes of importance were recently made. While raising from the 800- to the 650-ft. level good ore was encountered. Drifting on the 650-ft. level disclosed 35 ft. of ore, with ore still showing in the face. Shipments are being made at a rate of one carload per week to the El Paso smeltery. F. A. Woodward is general manager.

JAHNS MINING CO.—The property of this company is about 12 miles west of Miami; operations are to be resumed. The ore is in a faulted zone and contains lead, silver, gold and copper. The country is made up of limestone, quartzite and granite, shattered by intrusions of diabase. The group consists of 31 claims, being bordered by the Continental on the northeast and Castle Dome on the east. H. Jahns is general manager.

INSPIRATION CONSOLIDATED—Development for February amounted to 5220 ft. for the Inspiration division and 600 ft. for the Live Oak division, a total of 5320 ft. At the Inspiration a total of 20,400 tons of ore was mined, of which 9000 tons was hoisted at the Joe Bush shaft. At the Live Oak 2430 tons of waste and 370 tons of ore was hoisted at Live Oak No. 2 and 2100 tons of waste at Live Oak No. 1 shaft. A large number of mines have been laid off probably because of the advanced stage of underground development work and mill construction.

SUPERIOR & BOSTON—Two drifts are being driven on the sixth level. The drift west is in 35 ft., the one east 45 ft., with ore in both faces. The vein is more than 40 ft. wide and is ore-bearing throughout. The east drift will connect with the raise from the eighth level in about 60 ft. The ore still continues in the raise, and one car per day from the raise and the sixth-level drifts is being shipped to the El Paso smeltery. It is proposed to continue the crosscut on the fourth level to the vein, to determine the height of the ore and to provide ventilation. The crosscuts on the 10th and 12th levels should encounter this vein within the next few weeks. J. A. Thomas, formerly with the Old Dominion, has made a favorable report.

Mohave County

CLAIMS NEAR THE McCRACKEN PROPERTY have been purchased from W. H. Smith by C. L. Davidson, a large stockholder in the Arizona Southwestern Copper Co. R. C. Jacobson reported favorably on the property, and development work will be started immediately.

TOM REED—The total value of bullion shipped in February was $67,500. This decreased output was occasioned by temporary suspension of milling, due to freezing of the water supply and other troubles. In the first week in March a bar was shipped which was valued at $86,000.

FRISCO—Machinery for the addition to the mill is being hauled to the mill, the capacity of which will soon be increased to 100 tons per day. Subsequent additions and improvements are contemplated to increase the capacity to 500 tons daily. The available water supply now limits the tonnage of ore which can be treated.

TENNESSEE—Shipments averaging 200 tons of ore per day are being sent to the smeltery at Needles. Shipments were recently delayed for several days by a break in a part of the loading machinery. Development work is being kept well ahead of mining and is greatly increasing the tonnage of ore in sight.

COPPER CANYON—The crosscut on the Whale vein has developed 16 ft. of ore carrying copper, lead and molybdenum. A tunnel has been driven 85 ft. on the vein and is in ore all the way, while a shaft sunk to a depth 30 ft. below the level of the tunnel shows copper-molybdenum ore. The property is owned by Smith & Sawyer, W. J. Connor and L. J. Lassell, of Kingman.

Pinal County

LONDON-ARIZONA COPPER CO.—Shipments are being made.

A NEW FIND OF TUNGSTEN ORE is reported from the Saddle Mountain district by a prospecting crew searching for rare metals.

Yavapai County

POSTMASTER—This group has been leased by the Aladdin company, and work has been resumed.

CLIMAX—Repairs and remodeling of the mill have been completed and the mill is now in full operation.

JEROME-VERDE OIL CO.—Before the casing was inserted 10 bbl. of oil were secured from the new well at Cottonwood.

CALIFORNIA

Alameda County

MAGNESITE MINING ON RED MOUNTAIN is to be resumed, according to recent reports. The material is to be used in the manufacture of a fireproof compound for use in the form of paint to be applied to the woodwork of buildings. Several contracts are reported to be in negotiation in Oakland and San Francisco. The compound is said to have been invented by James Cummings, manager of the Porcelith Co., which will operate the mines. Red Mountain is at the junction of Alameda, Santa Clara and Stanislaus Counties. The mines in Stanislaus County were operated several years ago by Alvinza Hayward. Several other operators have mined magnesite in the three counties.

Amador County

SOUTH JACKSON—Ore has been disclosed at the 350-ft level where a station is being cut.

NEW YORK RANCH—A vein 10 in. wide near the surface has widened to 2 ft. at 20 ft depth. The ore is quartz carrying sulphides. H. C. Hambrick is owner.

BELLWETHER—This is an important location of two mining claims on ground said to be owned by the Kennedy Mining Co. The locator, H. D. Emerson, of Jackson, is continuing assessment work in spite of an adverse decision in a suit brought by him against the Kennedy company. Webb Smith, superintendent of the Kennedy, has given Emerson formal notice, on the ground, to stop work.

SOUTH EUREKA—The shaft is clear of the debris resulting from the caving in January. The installation of a ventilating blower is contemplated. The drift south to connect with the Oneida mine will be advanced. Good ore was recently disclosed on the 1800-ft. level of the Oneida. The two mines are owned and operated by the same company. W. H. Schmal, of Sutter Creek, is superintendent.

Eldorado County

NONPAREIL—This channel mine in the Georgetown district has been leased to I. P. Allen, of San Francisco. The channel has been prospected by shafts and is reported to be 250 ft. wide. Both blue and gray gravel have been disclosed.

Inyo County

WILSHIRE-BISHOP CREEK — The electrical machinery has been received and the motors installed. The wiring of the plant and the installation of the transformers is in progress. The work has been delayed by snow. The new mill will soon be in operation. It is expected to treat the tailing by cyanidation after the plant is in operation long enough to make complete mill-run tests by amalgamation. Laboratory tests are said to have shown 90% extraction by the cyanide treatment. Algernon Del Mar is superintendent.

Kern County

NORTH AMERICAN OIL CO.—Oil from this company's Bakerfifield property on Sec. 16, 32-23, is now running into the main pipe line of the eneral Petroleum Co.

San Benito County

CAPITOLA—Good ore is reported to have been disclosed in this quicksilver mine near Klau. A new furnace is being installed. William Lane and associates, owners.

PACIFIC QUICKSILVER CO.—The board of directors at San José has elected E. A. Waldron president, Alfred C. Eaton secretary, and appointed A. F. Eaton superintendent. The company announces that work will be resumed at the mine in the southeastern part of the county. The installation of new machinery is contemplated.

San Bernardino County

A STANDARD-GAGE railroad from Searles Lake, it is reported, is to be built to connect with the town of Searles. The Trona Railway Co. will build the road, the company having been incorporated with a capital stock of $200.000. The incorporators are Joseph K. Hutchinson, of San Francisco, and Walter Slack and W. R. Whyte, of Oakland. The backers of the enterprise are said to be the Foreign Mines Development Co. and the California Trona Co. The town of Searles is 12 miles north of Randsburg and in Kern County. It is connected by Southern Pacific R.R. with Mojave about 60 miles southwest. The new road will be about 32 miles long.

BROOKLYN—A 3-stamp mill is being built. David Henderson, of Dale, is superintendent.

UNITED GREENWATER COPPER CO.—A new mill is being built at the Supply mine. The ore will be ground to 20 mesh and be leached without agitation. There are six vats of 100 tons capacity each. At present the old tailing dump is being treated by cyanidation. Gasoline is used for power fuel. The new mill will be completed in April. The company is also developing the O. K. mine. The shaft is 800 ft. deep and on the vein. The property is equipped with a 10-stamp mill, which is idle pending development. Water for these mines is pumped over the mountain from a 200-ft. well 10 miles distant. John McGee, of Dale, is superintendent.

PACIFIC MINES CORPORATION—There are 58 claims in these holdings, eight miles south of Ludlow at Rochester camp. The company operates a standard-gage railroad to connect with the Santa Fé at Ludlow, and ships gold-silver-copper ore. Churn drills are used. A large part of the ore is exposed, and will be mined, open cast, then be loaded on the cars directly for shipment. The ore contains about 2% copper but is mined chiefly for gold. A new headframe is being erected at the main shaft of the deep workings, to replace the one destroyed by fire in January. The shaft is being straightened and retimbered. The gasoline hoist at the main shaft, recently broken down, is being repaired. In spite of these necessary repairs the company is shipping more than 100 tons of ore a day. Frank A. Keith, 505 Central Building, Los Angeles, is president. E. C. Small is superintendent.

Siskiyou County

SPRING GULCH TUNNEL CO.—A new vein of high-grade ore is reported to have been recently disclosed at this mine near Yreka.

BLUE LEDGE—It is reported that Michigan men are making an examination of this copper mine, situated on the state line between California and Oregon.

MONO—The new 100-ft. tunnel is about completed. A new working shaft will be sunk in order to reduce operating expenses. The mine is a producer and pays dividends. It is about six miles north of Yreka.

Sonoma County

SONOMA MAGNESITE CO.—The litigation covering a period of eight years has been terminated in the appellate court affirming the decision of the superior court and adjudging the company the owner of the magnesite deposits which have been extensively developed. It is reported that production will soon be undertaken. There are several deposits of magnesite in the county in the vicinity of Healdsburg and Cloverdale, and much development and some production is recorded by the State Mining Bureau.

COLORADO

Clear Creek County

WILCOX—It is reported that the development of this property will be resumed in the near future. The company holding the property under lease contemplates overhauling and repairing the main tunnel and drifting on the Paymaster, Commonwealth and Independence veins. If these developments are favorable the concentrating plant will be remodeled and placed in operation.

AETNA—Regular shipments have been maintained during the last year from the ground between raises Nos. 1 and 2. The vein is 20 in. wide. The ore is steel galena and chalcopyrite and is reported to be rich in gold and silver. On the East Aetna a raise was lifted 80 ft., from the top of which a drift was driven 20 ft. west in pay ore. The vein is 4 ft. wide. A 1-ft. streak of smelting ore assays about $80 per ton.

Gunnison County

BRANDT INDEPENDENT MINING CO.—The Roosevelt vein was cut by the Copper Mountain tunnel, 1465 ft. from the portal. Previous to striking this vein, stringers of ore were cut and it was thought that they merged with the main vein. In driving beyond the vein other similar stringers of ore were cut, and after the tunnel had been driven 1642 ft., and there was no change in the formation, it was decided to drift on the large vein. This work was started Mar. 1, and the ground being soft, good progress has been made and the vein looks promising. It is 28 ft. wide and the drift is being driven next to the hanging wall.

Lake County-Leadville

OWNERS OF CLAIMS IN HALF MOON AND LACKAWANNA GULCHES are already on the ground doing some work. In most cases they have been obliged to go into the country on snowshoes, but once having reached the claims work can be done in the tunnels and all of the men have comfortable cabins.

BLACK PRINCE—Work has been resumed.

YANKEE DOODLE—About three cars of lead-bearing iron ore are being shipped each week.

NEW DISCOVERY—A car of zinc-carbonate ore has been shipped by Frederick Hoffer; it was stripped from the old workings of the shaft at the north end of the property.

AMPHITHEATRE GOLD MINING CO.—Operations are to be resumed; the shaft wil be deepened before any other development work is considered. Ralph Roseberry is in charge.

San Juan Region

SMUGGLER UNION—Preparations are being made to extend the milling facilities. Additional men have been employed at the mines recently acquired under bond and lease from the Moorhead Mining & Milling Co. More men will be employed on the tramways, and the old mill will be used. The Moorhead claims are being worked through the old Sheridan adit.

BROWN MOUNTAIN SMELTING CO. — Col. Thomas B. Crawford has succeeded in financing this smeltery at Ouray and the machinery is being put into shape to resume operations in April. The company owns several properties in the Red Mountain district, notably the Indiana, which will yield copper ore. The Wanakah, a separate corporation, will furnish the iron fluxing-ore, which contains about $12 in gold. The other ores will be obtained from the Bachelor, Khedive, Newsboy and other mines in the northern part of the district. W. E. Kramer is business manager.

COLORADO-SUPERIOR MINING CO.—This is the reorganized Black Bear Mining Co. All stock of the old company has been placed in the hands of the International Trust Co., of Denver, as trustee, and will be issued to the stockholders of the new company in the near future. The officers and directors of the reorganized company are: George G. Wagner, president; J. S. Jasburg, secretary-treasurer; O. J. Larson, Jacob Ojanpera and Isaac Nevala. The old Black Bear company has been in litigation and has accumulated debts for several years. There are 900 stockholders. The new company contemplates resumption of operations in the near future.

Teller County-Cripple Creek

MARY McKINNEY—On the ninth level, a vein 4 ft. wide, and assaying about $30 is being mined. The stope has been opened for a distance of 100 ft. and about two cars of ore per day are being shipped.

C. K. N.—Pending the prospective settlement with El Paso, District Judge Little has ordered a cessation of work in C. K. & N. territory until the question of ownership is finally established. The purchase price is now estimated at $375,000, or 25c. per share for the $1,500,000 in stock.

IDAHO

Coeur d' Alene District

FRISCO—This mine and mill at Gem, were recently purchased by the Federal Mining & Smelting Co., and, as soon as the underground workings are drained, operations will be commenced. Mining and pumping machinery for the property has been ordered, and two bailing-skips of 1000 gal. capacity have arrived and will be used in unwatering the mine. It is said that a contract is to be let for driving 2000 ft. of tunnel from the mill level of the Frisco toward the Flynn group, which the Federal recently acquired.

MICHIGAN

Copper

INDIANA—The shaft is about 1380 ft. deep and at a depth of about 1400 ft. a station will be established and a crosscut started to cut the felsite, which should be reached within a few feet of the shaft.

HANCOCK—Further opening on the No. 8 lode of the Pewabic series, which was recently encountered about 120 ft. from the shaft, continues encouraging, the formation being well charged with heavy copper. Shipments are to be made from time to time as fast as the bins are filled from the underground openings and it is planned that by June 1 sufficient ground will be broken to maintain regular shipments to the mill.

COPPER RANGE—The 2000-kv.-a. low-pressure turbine at the Baltic mill has been installed and tested and while the company has not enough equipment connected to give the unit an actual working load, it showed under test that it is satisfactory and more than meets the manufacturers' guarantees. This company plans to install other similar units at the other stamp mills, supplying these units from one substation and utilizing the power for a general electrification of the mills and mines.

CALUMET & HECLA—Work at this company's electric power plant where a 9000 kv.-a. mixed pressure turbine is being installed, is progressing favorably. The foundations are completed and the greater part of the machinery has been received. At the new electrolytic plant, which is to be completed during the year, the contract for the electrical equipment has been closed and as soon as the weather conditions will permit the work on the building will be resumed, as the foundation was completed last autumn. One of the two large refining furnaces which were erected during the last year and which was blown in recently, is working satisfactorily.

Iron

FOR MINE RESCUE CAR NO. 8 of the U. S. Bureau of Mines, the following itinerary in the Iron Mountain district, is planned: Florence Iron Co., and Reserve Mining Co., Florence, Wis., Mar. 31 to Apr. 5; Penn Iron Mining Co., Loretto, Aragon and Chapin mines, at Vulvan, Mich., Apr. 1 to Apr. 12; Oliver Iron Mining Co., Pewabic, and Traders mines, at Iron Mountain, Apr. 14 to Apr. 19.

MISSOURI

Joplin District

MUCH DRILLING IS BEING DONE in the vicinity of Spring City with promising results. Drilling is to be continued for several months on a 600-acre tract 1½ miles south of town. Four holes have been drilled on the Connor estate, all showing lead at a depth of 130 ft. One indicated a 15-ft. face of zinc ore at a depth 220 ft. Sinking of a shaft is contemplated. Drilling is also in progress on the Waddel land between the Onondaga mine and the Spring City Lead & Zinc Co. property.

YELLOW GOSLING—A new mill is to be built at this mine in the Klondike district. The mine is operated by O. W. Sparks and is near his Yellow Jacket mine.

GENERAL LEAD & ZINC CO.—This company's Filipino mill in Gordon Hollow has been converted into a custom plant by Grant & Vogt, who have taken a lease on five lots of the property. The intention of the lessees is to mill their own ore and that of sublessees.

SNAPP LAND—Two new mines are being developed on this land at Thoms Station. Ortt & Coats, who hold a first lease from the Sheridan-Adams Royalty Co., have sunk 35 drill holes and two shafts on a 20-acre lease southwest of the Sitting Bull. A two-weeks run of the ore through a custom mill was recently completed. The lower 25 ft. of the orebody is believed to be rich in zinc and lead. Plans are being made for a mill. The Vinegar Hill Mining Co. of Wisconsin has a sublease on a 10-acre tract adjoining the Ortt & Coats land and on which 17 drill holes and a shaft have been sunk. The drill cuttings showed good zinc and lead ore and 60 loads of ore milled at a custom plant yielded well. Orders have been given to dismantle the plant at Carl Junction and move it to the new lease.

MONTANA

Butte District

RAINBOW—As soon as the shaft on the Third Sphinx claim, and which is now 225 ft. deep, is down 800 ft., development work will be started, and the large block of ground recently acquired by the company, thoroughly explored. General Manager John D. Pope, of the North Butte company, is in charge of operations.

BULLWHACKER—During operations in the glory hole at this property in the eastern part of the Butte district a rich body of cuprite ore assaying 19½% copper was recently opened. The extent of the find has not yet been ascertained, but ore shipments to the Washoe smeltery have been somewhat increased as a result.

ANACONDA—The Neversweat mine has been closed down for retimbering the shaft throughout, and no ore will be hoisted for six or seven months. During this time a new foundation for the hoisting engine will be put in place, and a new steel headframe erected. It is the intention of the company to continue to operate this mine after the improvements have been made, with steam power, and not to install compressed-air hoisting engines, as is being done in most of the other properties. In case th management decides that the Neversweat must be made to produce a certain amount of ore during the time the shaft is closed, it will be possible to do so by hoisting through the Anaconda shaft which is connected with these workings on several levels, but as a number of changes are being made in the Washoe smeltery at Anaconda, preventing the plant from making its usual output, it is not probable that any call for ore will be received that cannot be easily handled by other producing properties of the company.

Broadwater County

DOBLER—A force of 25 men is employed on this gold property about one mile from Clasoil. The shaft has reached a depth of 150 ft. and several development crosscuts, drifts and tunnels, are being driven.

KEATING—Work has been started on the erection of buildings at this mine in the Radersburg district for the installation of a 50-ton gold and silver milling plant. A new process will be used. There are large tonnages of low-grade ore in the Radersburg district which has not been mined for lack of proper treatment facilities, and the company has announced that as soon as the practicability of the mill has been assured, it will be enlarged so as to treat custom ore.

Fergus County

BARNES-KING—The annual meeting was held Mar. 5, at Kendall, and the officers and directors were reëlected. The officers are C. W. Goodale, president; C. C. Swinborne, treasurer; and J. E. Corette, secretary, all of Butte.

Granite County

SWASTIKA MINING CO.—This company is being organized by W. W. Williams to develop several claims near Phillipsburg, owned by C. E. Hansen, Joel Wills, and the estates of Hansen, Henry Kroger, and Conrad Wipf. From surface cuts and shallow shafts small amounts of copper ore have been mined. A shaft will be sunk from 300 to 500 ft. in depth, and crosscuts will be driven to the veins.

Madison County

HIGH UP—Plans are being made for a mill at this property in Brown's Gulch, in which the low-grade ores will be treated. E. W. Merritt, manager, has gone to Duluth to consult with the owners upon the proposed installation.

MONTROSE—Eastern men have become interested in this group of claims in the Rochester district and will soon begin development work. The group, consisting of eight claims, is owned by James Miller, Isaac Hanson, and John Mahoney, of Twin Bridges.

NEVADA

Comstock Lode

SILVER CITY—High-grade ore is reported on the Murtaugh group located south of the Occidental claim.

CROWN POINT—During the last year a total of 29,447 tons of ore was worked at the Yellow Jacket mill, the gross assay value of which was $166,500.

Nye County

SHIPMENTS in tons from Tonopah mines for the week ended Mar. 15:

Tonopah Mining	3,350	North Star	....
Tonopah Belmont	2,834	Mizpah Extension	....
Montana-Tonopah	1,212	Jim Butler	350
Tonopah Extension	1,050	Tonopah Merger	225
West End	1,060		
Midway	100	Total	10,735
MacNamara	554	Estimated value	$228,424

White Pine County

RECENT SNOWFALLS WILL RETARD PRODUCTION in the open pits.

GIROUX—Another hoist, obtained from the Veteran mine, is being placed at the Bunker Hill shaft.

NEVADA CONSOLIDATED—Mining and milling operations are being carried on at full capacity.

COPPERMINES CO.—Since Jan. 1, eight carloads of ore have been shipped to Steptoe smeltery. A tramway is now in operation between the ore bins at the mine and those at the railroad track.

BOSTON & ELY—The quantity of water encountered in the new vein on the 1200-ft. level in driving toward the Matilda vein, has proved too much for the recently installed pumps, and the mine has been shut down

MCDONALD-ELY—The Golden Gate shaft, which recently caved badly, has been repaired and is now in operation to the water level. A pump has been put in position and unwatering of the old workings has been commenced. Some lessees on the Centennial company's property, on the east side of McDonald-Ely ground, are working a narrow streak of high-grade copper ore which they are sacking for shipment.

NEW ELY CENTRAL—A proposition has been made to the directors of this company by which a deed to the property is to be placed in escrow, to be delivered to the Mines Development Co. on or before Jan. 1, 1915. The Mines Development Co. will immediately commence to drill and prospect the ground. In case the deed is taken up, the New Ely Central stockholders will be paid $1 per share for their stock, except the trust or treasury stock, or bonds outstanding. An alternative offer is that stock of the New Ely Central Co. or bonds at par may be turned in and exchanged for stock of the company to be formed to develop and work the property, the capital of which would be about $6,000,000, at the price at which such stock is underwritten.

OREGON

Josephine County

HUMBOLDT—The management of this mine is making arrangements to enlarge the plant and to resume operations. The mine has been idle for several years.

TAYLOR, WORSHAM & CO.—A stamp mill has been built and is being operated 24 hr. daily, at the old White and Blue property, which was recently purchased from G. H. Bodfish.

R. R. DREDGE CO.—This company has been operating a drag-line bucket dredge for the last four months and has made a successful run so far this season. A more modern plant will probably be installed this season.

UTAH

Juab County

DELMAR—Work is being done at this property in North Tintic.

SELMA—Arrangements are being made for resuming sinking in the 200-ft. shaft.

TINTIC CENTRAL—The raise from the 1020 level is up 65 ft., and is approaching the quartz cut on the level above.

SCRANTON—Development is being done, and shipments will not be resumed until the electrically driven hoist and compressor have been placed in commission.

MAY DAY—The new lead oreshoot on the 1000 level is opening well, and there is reported to be not less than 2000 tons of ore now exposed.

U. S. SMELTING, REFINING & MINING CO.—It is reported that an option has been secured on the King William, adjoining the Centennial-Eureka, from which shaft drifts will be driven into King William ground.

OPOHONGO—Most of the shipments made from this property are coming from new stopes below the 700, where ore is being mined both north and south of the winze. This ore contains copper, silver and gold. Some ore is also being mined on the 450 level.

EUREKA HILL—The first shipment, of about 100 tons, from the Clark-Christopherson lease has been made. Other leases have been asked for, and will probably be granted, if arrangements can be made for hoisting through the Bullion Beck shaft. The Eureka Hill shaft timbering is not in good condition.

GRAND CENTRAL—There is a good showing of ore on the lowest levels. Mining is being done on the 1800, 2000, 2200 and 2300 levels. Sinking is still in progress in the winze below the 2300, and although the ore has been passed through the bottom is still in mineralized ground. When the 2400 level is reached, drifting from the winze will be started. The workings are the deepest in the district, and water has not yet been encountered.

Salt Lake County

GEOLOGICAL SURVEY WORK in Big and Little Cottonwood cañon, including Alta, is desired by the mine owners and efforts will be made to have such work done.

SOUTH HECLA—Work suspended for a short time has been resumed at this property.

OHIO COPPER—A general balance sheet dated Dec. 31, 1912, has been issued, showing $562,055 cash assets, accounts receivable, etc.

TAR BABY—Pockets of galena are reported to have been opened in drifting along the main fissure. At places the carbonate ore has been as much as 1 ft. wide. The property is in Big Cottonwood Cañon.

UTAH APEX—A statement of operations for January, issued by the Boston office, shows receipts from ore sales, etc., to have been $39,880, operating expenses, $28,738. Profits from mining operations were $11,147, less $1654 interest on bonds and other fixed charges, leaving a net profit of $9493. Operating expenses included $5625 spent in new development. The total ore mined was 9217 tons.

WASHINGTON

Ferry County

REPUBLIC MINES CORPORATION—Plans are being formulated for the consolidation of this company and the North Washington Power & Reduction Co. Several other mining companies will probably be absorbed later. The consolidation plan contemplates the operation of the North Washington Power & Reduction Co. solely as an ore-treating enterprise and energy to drive the machinery in the mines and mill will be secured from other sources. The proposal to merge the two corporations has been formally presented to the directors, and Robert A. Koontz, president of the Reduction company, A. B. Willard, vice-president of the Republic Mines Corporation, and W. O. Jones, auditor for the last company, have been selected as a committee to prepare the suggestion for presentation to the stockholders of the two companies at a meeting which was to be held about Mar. 21. An increase in the capacity of the reduction works will probably be made in case of consolidation.

WISCONSIN

Platteville District

MIDWAY—George Jarrett and others have taken over this property, at Cuba, and will reopen the mine.

GRANT COUNTY—This mine has been subleased to W. J. Power, of Hibbing, Minn., under one year's option to buy.

EAU CLAIRE—Local men have leased the 60-acre tract of H. E. Stephens, one mile west of Platteville, and will continue development.

PRESTON POINT—The Wilson Mining Co., recently incorporated, has subleased this property at Potosi, to Milwaukee men. A valuable discovery of zinc ore has been made by churn drilling.

CANADA

British Columbia

BRITISH COLUMBIA COPPER CO.—The second payment on the Eureka group, amounting to $8000, has been made by this company to the Eureka Gold Mining Co.

CORINTH—Andrew Murphy, the original locator of the Idaho-Alamo mine near New Denver, has organized a company to operate this mine near the Idaho and is ready to start operations. A tunnel will be driven to cut the ore.

Ontario-Cobalt

PENN CANADIAN—High-grade ore has been found on the fifth level.

CURRIE—A diamond drill will be used to test this South Lorraine property.

LAWSON—A new oreshoot 5 in. wide, yielding ore, some of which assays 5000 oz. of silver, has been cut on the 115-ft. level.

EASTBOURNE-COBALT—This property has been taken over by a new development company and will be actively developed.

BARTLETT—The Scottish Nigeria Mining Co. has acquired a controlling interest in this mine in the Gowganda district, which it has been operating for some time, with A. M. Wylie in charge.

TIMISKAMING—The drift on the 575-ft. level has opened a 70-ft. oreshoot; some of the ore assays 2500 oz. per ton. This vein is in the diabase at a distance of about 70 ft. below the Keewatin.

McKINLEY-DARRAGH—In the year 1912, 2,717,383 oz. of silver were recovered. The gross output amounted to $1,621,010, while the net profits were $1,153,848. The total cost per ounce was 18.59c. Ore reserves are estimated at 5,368,500 ounces.

SHIPMENTS of ore and concentrates in tons, from Cobalt mines for the week ended Mar. 22 were as follows:

Bailey	.....	Kerr Lake	.....
Beaver	.....	La Rose	115.55
Buffalo	.....	Lost and Found	.....
Casey Cobalt	.....	McKinley-Darragh	65.70
Chambers-Ferland	.....	Nipissing	93.81
City of Cobalt	.....	Nipissing Reduction	.....
Cobalt Lake	.....	O'Brien	32.65
Cobalt Townsite	34.85	Penn.-Canadian	.....
Colonial	.....	Provincial	.....
Coniagas	.....	Right of Way	.....
Crown Reserve	.....	Seneca Superior	30.63
Dominion Reduction Co.	32.75	Silver Queen	.....
Drummond	.....	Timiskaming	.....
General Mines	.....	Trethewey	.....
Green Meehan	.....	Wettlaufer	.....
Hargraves	.....		
Hudson Bay	.....	Total	405.94

Ontario-Porcupine

DOME LAKE—By Apr. 10, the management expects to have the new mill in operation.

CARTWRIGHT GOLD FIELDS—A trial shipment from this Painkiller Lake property assayed $38 per ton.

MATCHETT-MURRAY—This property at Kirkland Lake has been taken over by the Timiskaming & Hudson Bay Mining Co.

McENANEY—It is stated that the mill is treating 50 tons of ore per day and that the heads assayed about $35 for the first half of March. The drift on the 200-ft. level has been driven for 600-ft., all in ore.

MEXICO

Guanajuato

MINERAL DEVELOPMENT CO.—The crosscut which is being driven from the Nueva Luz shaft to the Mother Lode has opened 2½ ft. of sulphide ore carrying silver and gold. It is expected to cut the lode within 750 feet.

Hidalgo

LA BLANCA Y ANEXAS—This company has exercised its option on the Cinco Señores mines and is now paying monthly instalments of 10,000 pesos on the purchase price. The purchase of other properties in this district is being considered. The company is preparing to increase its milling capacity to 15,000 tons per month and is putting the mines in shape to supply that tonnage.

CIA MINERA Y FUNDIDORA DE ZIMAPAN—This company was recently formed in Mexico City, with a capital of 460,000 pesos, to operate the La Cruz and adjoining mines in the Zimapan district. There is a small smeltery at the mines and two new 50-ton furnaces have been purchased. The Pachuca & Zimapan R.R. has been completed to within 54 km. of Zimapan. It is expected to have the roads completed to Orizaba, 34 km. from Zimapan, by June, 1913

Mexico

EL ORO MINING & RAILWAY CO., LTD.—In February, 20,020 tons of ore and 13,370 tons of tailings yielded bullion worth $174,130; the net profits being $62,840.

Sonora

MINNEAPOLIS COPPER CO.—Shipments to the Copper Queen smeltery at Douglas, Ariz., are being continued. The erection of the new smeltery has been delayed by the shortage of labor, but it is now believed that the plant will be ready for blowing in some time in March.

CANANEA CONSOLIDATED—According to press dispatches, General Manager L. D. Ricketts has stated that the smeltery will have to be shut down on account of shortage of fuel. The burning of several bridges on the Southern Pacific and El Paso & Southwestern railroads by rebels and federals has cut off the fuel supply.

THE MARKET REPORT

METAL MARKETS

NEW YORK—Mar. 26

The metal markets have been inclined to be quiet, and no important changes are to be noted for the week.

The conversion of the currency of Nicaragua to a gold basis began Mar. 22. The new monetary unit, called the "Cordoba," is of the same weight and fineness as the United States dollar. The paper peso, which has been the unit, is received at the rate of 12½ pesos for one cordoba, or 8c. gold to the peso. Six months will be allowed for the exchange.

Gold and Silver Movement in the United States, two months ended Feb. 28, as reported by the Bureau of Foreign and Domestic Commerce:

	Gold		Silver	
	1912	1913	1912	1913
Exports	$12,504,497	$29,611,057	$11,149,681	$11,749,755
Imports	8,078,517	11,566,806	8,138,486	6,681,046
Excess	E. $4,426,980	E. $18,044,251	E. $3,011,195	E. $5,068,709

Exports of merchandise for the two months this year were valued at $421,058,846; imports, $312,632,652; excess of exports, $108,426,194; this, with the precious metal exports, makes a total of $131,539,154 export balance.

Gold, Silver and Platinum

Gold—The price of gold on the open market in London was unchanged at 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. There was a strong demand from Germany, but no premiums were paid. For the two months ended Feb. 28, the gold taken for India was £6,021,200, against £8,609,000 last year.

Iridium—Demand continues good and supplies are short. The price still ranges about $85 per oz., New York.

Platinum—The market is steady and unchanged. Quotations are $45@46 per oz. for refined platinum and $49@53 per oz. for hard metal.

Silver—The market seems to have steadied itself at current rates after the heavy decline which has been going on for some weeks past owing to dear money and disappointment over the failure of the six-power China loan.

Exports of Silver from London to the East Jan. 1 to Mar. 6, reported by Messrs. Pixley & Abell:

	1912	1913	Changes	
India	£1,326,300	£1,481,900	I.	£155,600
China	400,000	95,000	D.	305,000
Total	£1,726,300	£1,576,900	D.	£149,400

Shipments of gold to India were £256,000 for the week.

Copper, Tin, Lead and Zinc

Copper—More business has been reported this week than in the previous week, but concessions in price were necessary to effect it. Even so the volume was small, relatively speaking and the market is rightly characterized as dull. Some business was done with domestic manufacturers, but the price had to be cut to basis of about 14.60c., cash, New York, in order to effect it. A larger tonnage was sold for export on about the same basis. At first the concessions were made by the smaller agencies, but toward the end of the week certain of the larger ones also reduced prices. The movement has been rather peculiar in view of the improvement in the London standard market. The dealings in Lake copper, so far as reported, have been scarcely worth mentioning. Trifling sales of ordinary brands have been made at about 14⅞c. In the absence of any pressure to sell or any special desire to buy quotations in this market are but nominal. At the close the market is rather unsettled, but no decisive movement one way or the other is looked for. We quote Lake at 14½@15c., and electrolytic at 14.55@14.65c. Casting copper is quoted nominally at 14.45@14.50c. as average for the week.

There were only three business days in London, the Exchange being closed on March 21, 22 and 24. Speculative sentiment has improved due to the easing-off in financial conditions on the continent and the better political outlook. Standard is working back to its normal proportion to refined sorts, and closes at £65 5s. for spot, and £65 12s. 6d. for three months.

Base price of copper sheets is 21@22c. per lb. Full extrase are charged, and higher prices for small quantities. Copper wire is 16½c. carload lots at mill.

Copper exports from New York for the week were 15,153 long tons. Our special correspondent gives the exports from Baltimore at 3071 tons for the week.

Tin—On account of the Easter holidays, which kept the London Metal Exchange closed from Friday of last week until Tuesday of this week, traders in this market assumed a waiting attitude, both sellers and buyers preferring to await developments in the London market before resuming operations. The metal went strong on the resumption of business, retaining its firmness until the close. Quotations ad-

DAILY PRICES OF METALS

NEW YORK

Mar.	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
20	4.8715	56⅞	14¾ @15	14.65 @14.70	46½	4.30 @4.35	4.15 @4.20	6.00 @6.05	5.85 @5.90
21	.....	56⅞	14¾ @15	14.60 @14.65	46½	4.30 @4.35	4.15 @4.20	5.95 @6.05	5.80 @5.90
22	4.8720	56¾	14¾ @15	14.55 @14.65	46½	4.30 @4.35	4.15 @4.20	5.90 @6.00	5.75 @5.85
24	.....	56¾	14¾ @15	14.55 @14.65	46½	4.30 @4.35	4.15 @4.20	5.85 @5.95	5.70 @5.80
25	4.8740	56⅝	14¾ @15	14.55 @14.65	46⅝	4.30 @4.35	4.15 @4.20	5.85 @5.90	5.70 @5.75
26	4.8705	57	14¾ @15	14.55 @14.65	47	4.30 @4.35	4.15 @4.20	5.85 @5.90	5.70 @5.75

The quotations herein given are our appraisal of the market for copper, lead spelter and tin based on wholesale contracts with consumers without distinction as to deliveries; and represent, to the best of our judgement, the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic. We quote casting copper at 0.15c. below the price for electrolytic. The quotations for lead represent wholesale transactions in open market for good ordinary brands, both desilverized and non-desilverized; the specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium. Silver quotations are in cents per troy ounce of fine silver.

LONDON

Mar.	Silver	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
		Spot	3 Mos	Best Sel'td	Spot	3 Mos		
20	26 1/16	64¼	64⅜	70	210¼	206¾	16	24½
21	....	....	....	....	....	....	....	....
22	26⅛	....	....	....	....	....	....	....
24	....	....	....	....	....	....	....	....
25	26 1/16	64½	64⅝	70	212	208½	16½	24½
26	26⅛	65¼	65⅜	70⅝	214¼	210½	16⅝	24½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb, except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, pot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 21¾c.

vanced easily, and close at £214 5s. for spot and £210 10s. for three months, and at about 47c. for April tin in New York.

Lead—The market is quiet and unchanged at 4.15@4.20c. St. Louis, and 4.30@4.35c. New York.

The European market has been strong and advancing on account of the reduced shipments from Mexico, where smelting and mining operations are more or less hampered by the revolution. The close is cabled at £16 7s. 6d. for Spanish lead and 7s. 6d. higher for English.

Spelter—There has been a singular absence of demand on the one hand, and on the other quite a little nervousness on the part of smelters to dispose of their product. Their anxiety to sell has been coupled with rumors from Washington about the proposed change in the tariff rates affecting their industry. In consequence, the market is in a rather demoralized condition. Sellers who were putting most pressure on the market during the previous week were undercut by other sellers last week. The last reported sales were at 5.70@5.75c., St. Louis basis, and we quote that for the close of the market week, but it was doubtful if that price could be realized on further offerings.

The London market is unchanged at £24 10s. for good ordinaries, and £24 17s. 6d. for specials.

Base price of zinc sheets is $8.25 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

COPPER SMELTERS' REPORTS

This table is compiled from reports received from the respective companies, except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept. of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield thereof is reckoned at 95%. In computing the total American supply duplications are excluded.

	Nov.	Dec.	Jan.	Feb.
Alaska shipments	1,671,367	3,766,029	1,668,328	660,250
Anaconda	24,250,000	23,400,000	21,000,000	21,250,000
Arizona, Ltd	3,000,000	3,100,000	3,100,000	3,000,000
Copper Queen	8,807,940	8,805,568	7,554,966	6,810,706
Calumet & Arizona	4,918,000	5,840,000	4,750,000	4,050,000
Chino	3,911,169	3,368,850	2,903,030	3,813,998
Detroit	1,968,620	2,389,875	1,769,071	1,689,277
East Butte	1,245,504	1,314,021	1,469,000	.....
Mammoth	1,805,869	1,850,000	.....	.....
Giroux	*nil*	625,000	.....	.....
Mason Valley	1,500,000	1,550,000	1,575,100	.....
Nevada Con.	4,160,533	3,975,631	4,169,705	4,798,531
Ohio	573,614	566,816	.....	.....
Old Dominion	2,758,000	2,727,000	2,727,000	2,381,000
Ray	3,191,026	3,638,500	3,610,000	3,610,000
Shannon	1,435,709	1,361,420	1,232,000	1,152,000
South Utah	*nil*	*nil*	.....	.....
United Verde*	2,900,000	3,000,000	2,900,000	2,750,000
Utah Copper Co.	4,562,417	5,676,484	7,182,495	7,585,303
Lake Superior*	20,400,000	18,300,000	17,500,000	19,000,000
Non-rep. mines*	8,250,000	7,750,000	7,500,000	.....
Total production	101,309,798	103,005,194	.....	.....
Imports, bars, etc.	22,797,099	28,761,087	34,026,236	.....
Total blister	124,106,897	131,766,281	.....	.....
Imp. in ore and matte	8,149,728	10,385,662	7,563,758	.....
Total American	132,256,625	142,151,943	.....	.....
Miami†	2,972,000	2,913,840	2,932,369	2,817,200
Brit. Col. Cos.:				
British Col. Copper	881,582	.....	.....	.....
Granby	1,852,896	.....	1,792,245	1,740,000
Mexican Cos.:				
Boleo†	2,315,040	2,480,240	2,658,880	2,535,680
Cananea	5,064,000	5,592,000	.....	4,880,000
Moctezuma	2,112,377	2,793,781	2,913,294	2,730,914
Other Foreign:				
Braden, Chile	1,028,000	910,000	1,484,000	1,178,000
Cape Cop., S. Africa	907,200	750,560	770,540	.....
Kyshtim, Russia	1,523,200	1,489,600	1,644,160	.....
Spassky, Russia	974,400	974,400	974,400	.....
Exports from				
Chile	4,816,000	7,392,000	6,752,000	5,824,000
Australia	10,752,000	9,856,000	9,744,000	5,512,000
Arrivals in Europe‡	12,976,320	16,363,200	17,689,280	8,509,760

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

‡ Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER

	United States			Visible Stocks.		
Month	U.S. Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
II, 1912	116,035,809	56,228,368	53,148,096	66,280,643	154,851,200	221,131,843
III	125,694,601	67,487,466	58,779,566	62,939,988	141,142,400	204,082,387
IV	125,464,644	69,513,846	53,252,326	62,367,557	136,819,200	199,186,757
V	126,737,836	72,702,277	69,485,945	695,066,02	134,176,000	199,242,029
VI	122,315,240	66,146,229	61,449,650	49,615,643	117,801,600	167,417,244
VII	137,161,129	71,094,381	60,121,331	44,335,004	108,186,000	152,521,003
VIII	145,628,521	78,722,418	70,485,150	50,280,421	113,299,200	163,579,621
IX	140,089,819	63,460,810	60,264,796	46,701,374	113,568,000	160,269,374
X	145,405,453	84,104,734	47,621,342	63,065,587	107,408,000	170,473,587
XI	134,695,400	69,369,795	55,906,550	76,744,964	103,801,600	180,546,564
XII	143,354,042	58,491,723	65,713,796	86,164,059	96,947,200	183,111,259
Year, 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
I, 1913.	143,479,625	65,210,030	60,383,845	105,312,582	78,491,840	183,904,422
II	130,948,881	59,676,492	72,168,523	123,198,332	77,504,000	200,702,332
III	.....	.....	.....	122,302,890	81,244,800	203,547,690

Note—From Jan. 1, 1913, visible supplies in Europe do not include copper afloat.

Other Metals

Aluminum—The market is strong and demand continues good; early deliveries are in request. Prices are firm and 27@27½c. per lb. is still asked for No. 1 ingots, New York. The foreign market is strong.

Antimony—The market has been very dull, hardly more than a retail business doing. Prices are softer, Cookson's being quoted at 9@9.25c. per lb. and Hallett's at 8.50@8.75c.; while 7.90@8.25c. is asked for Hungarian, Chinese and other outside brands.

Quicksilver—The market remains rather quiet, and there is no material change in prices. The New York quotation may be given at $39@40 per ask of 75 lb., with 58@59c. per lb. for small lots. San Francisco $40 for domestic orders and $37.50 for export. London price is £7 10s. per flask, with £7 5s. named from second hands.

Bismuth—The syndicate which controls the European production quotes 7s. 6d.—equal to $1.80—per lb. in London. In New York a quotation of $1.72 per lb. is made for metal produced from American ores.

Nickel—Shot, block and plaquettes are quoted at 40@45c. per lb., according to quality and size of order. Electrolytic nickel is 5c. per lb. higher.

Selenium—Producers of this metal quote large lots at $2.75@3.50 per lb., according to size of order; while as high as $4.50@5.50 is paid for retail lots.

Cadmium—The latest quotation from Germany is 725@750 marks per 100 kg. f.o.b. works in Silesia. This is equal to 78.27@80.97c. per lb. at works.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Exports and Imports of Metals, other than iron and steel, in the United States in January are reported as follows:

	Exports		Imports	
Metals:	1912	1913	1912	1913
Copper, long tons	32,064	32,389	17,917	18,567
Tin, long tons	34	35	3,306	3,899
Lead, short tons	3,605	2,969	9,249	10,579
Zinc, short tons	1,007	172	2,189	5,302
Zinc in ore, lb.	2,747,234	.....	3,335,087	8,700,403
Nickel, lb.	1,584,986	3,188,877	2,758,843	4,697,110
Antimony, lb.	.....	19,130	1,283,298	2,296,501
Aluminum, lb.	1,690	5,307	1,301,375	3,179,774
Platinum, oz.	.....	.....	8,215	12,875
Ores, etc.				
Zinc oxide, lb.	2,285,837	2,132,405	.....	.....
Zinc dross, lb.	276,450	48,690	.....	.....
Zinc dust, lb.	.....	14,000	.....	352,714
Zinc ores, tons	.....	1,530	5,828	6,904

Copper, lead, nickel and antimony include the quantities of metal in ores, matte, bullion, etc. Quantity of antimony ore is not given. Zinc dust was not given separately last year. The exports include reëxports of foreign material.

Zinc and Lead Ore Markets

JOPLIN, MO.—Mar. 22

The high price paid for zinc blende was $51, the base range being $42@48 per ton of 60% zinc. Calamine sold on a base of $25@27 per ton of 40% zinc. The average of all grades is $45.86 per ton. This is an advance of 60c. per ton over last week, when a very heavy shipment of low-valued calamine was made. The high price of zinc blende declined $2 and the average $1.20, while the calamine average was advanced. No change was noted in the calamine price range, but blende suffered from the drop in spelter. The lead market is unchanged at $55.50 high for ore selling on a base of $53.50 per ton of 80% metal contents.

SHIPMENTS, WEEK ENDED MARCH 22

	Blende	Calamine	Lead Ore	Value
Totals for week...	10,635,510	694,940	1,859,220	$309,463
Twelve weeks....	123,363,300	8,580,010	22,552,180	$3,763,383

Blende value, the week, $250,276; 12 weeks, $3,044,768.

Calamine value, the week, $9574; 12 weeks, $123,256.

Lead value, the week, $49,553; 12 weeks, $595,359.

IRON TRADE REVIEW

NEW YORK—Mar. 26

The feature of the market is the number of inquiries for third-quarter and second-half business, and it looks as if many contracts would be placed for such business before long.

Outside of this business continues in much the same condition as for several weeks past. The mills are busy and still find difficulty in keeping up with their orders.

Pig iron is still rather dull in the Central West, but is in better demand in Seaboard territory.

PITTSBURGH—Mar. 25

What is probably a record flood has been reaching its height in the Mahoning and Shenango Rivers, resulting in the majority of steel mills and finishing mills in the two Valleys being closed. Yesterday some steel mills were closed, while others have closed at various times today. The extent of the floods cannot yet be determined, and there are also troubles from railroad traffic being interrupted, several of the trunk lines west of Pittsburgh being tied up. There is no likelihood of any of the mills resuming operations before Monday, and at the least there will be about a week's interruption to production at plants producing between 10 and 20% of the country's total output.

Under date of Mar. 22, the American Steel & Wire Co. notified the trade of an advance of $1 a ton in wire products, independents also observing the advance, which became nominally effective Mar. 24. The new prices are: Plain wire, 1.60c.; galvanized wire, 2c.; wire nails, $1.80; painted barb wire, 1.80c.; galvanized barb wire, 2.20c. The total advance in wire products on this movement, which began in December, 1911, is now $6 a ton.

Market conditions have undergone no general change in the past week. On the one hand, there has been increased contracting for late delivery in a few lines, particularly in steel bars, while on the other hand there has been somewhat more shading in a few lines, particularly sheets and merchant pipe.

March will make a new record in the steel industry for production and shipments. Shipments are very well taken, and there is no evidence of buyers stocking material to any extent. While there are many who have doubts as to the state of trade in the second half of the year, the outlook seems to be altogether favorable.

Pig Iron—Bessemer iron is quotable 25c. lower, at $17, Valley. The market has been almost nominal for some time, with practically no sales reported, but it is now learned that some small lots, as well as one lot of 5000 tons, have gone at $17. This is the first decline in bessemer iron on this movement. The Carbon Steel Co., Pittsburgh, has purchased 7500 tons for third quarter at about $16.90, delivered, and the basic market becomes quotable at $16, Valley, as a minimum, representing a total decline on the movement of 50c. Foundry iron is quotable 25c. lower, making $1.75 decline. We quote: Bessemer, $17@17.25; basic, $16@16.25; No. 2 foundry, $16.25; forge, $15.75; malleable, $16.25@16.50, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

A furnace company in Cleveland has contracted for 5000 tons of Connellsville furnace coke a month, April to June, inclusive, at $2.25, the first contract for some time. Operators generally are asking $2.50 on contract. Prompt furnace coke has sold at $2.45, and is quotable at this figure, with off-grade coke offered at $2.15 or less.

Ferromanganese—The market has been rather weak, with not much tonnage moving. Small prompt lots are frequently offered at a concession of $1 a ton, and occasionally more, while there is at least one seller on contract at $1 concession. We quote prompt and contract at $64@54, Baltimore.

Steel—One or two mills have been selling billets and sheet bars for second-half delivery in a limited way, at prices not reported. For any early delivery no steel is offered, except odd lots by jobbers, at about former prices, $29 for billets and $30 for sheet bars, maker's mill, Pittsburgh or Youngstown. These are regarded as "squeeze prices," and would not be asked for extended deliveries. Rods are quotable nominally at $30, maker's mill.

IRON ORE

Imports of iron ore into the United States in January were: From Cuba, 104,575; Sweden, 28,185; Spain, 22,979; Newfoundland and Labrador, 15,418; miscellaneous, 4306; total, 175,463 tons, an increase of 21,345 tons over January, 1912. Exports of iron ore, 11,867 tons in 1912, and 13,896 in 1913; increase, 2029 tons.

Imports of manganese ore in January were 28,401 tons in 1912, and 55,543 in 1913; increase, 27,142 tons.

Imports of iron ore in Great Britain, two months ended Feb. 28, were 1,181,141 tons in 1912, and 1,346,547 in 1913; increase, 165,406 tons.

COAL TRADE REVIEW

NEW YORK—Mar. 26

The coal trade continues in fair shape. Domestic trade is, of course, quiet, on account of the continued mild weather, but steam trade is good in the West. In the East, also, there is a steady demand for steam coal.

Anthracite trade is very quiet, but a revival is expected after this week. Coal is beginning to go to the storage yards in fair quantity.

Coal and Coke Carried on Pennsylvania R.R. lines east of Pittsburgh and Erie, two months ended Feb. 28, short tons:

	1912	1913	Changes
Anthracite	2,147,761	2,002,295	D. 145,466
Bituminous	7,668,282	8,067,500	I. 399,218
Coke	1,964,184	2,508,874	I. 544,290
Total	11,780,227	12,578,669	I. 798,442

The total increase this year over 1912 was 6.8%. The heaviest gain this year was in coke.

Exports and Imports of Fuel in the United States in January were, in long tons:

	Exports		Imports	
	1912	1913	1912	1913
Anthracite	221,638	305,569	10	6
Bituminous	667,479	975,963	124,788	126,295
Coke	53,114	81,110	8,862	6,617
Steamer coal	553,140	612,689	.....	.....
Total	1,495,371	1,975,331	133,660	132,918

The bunker coal, or coal furnished to steamships in foreign trade, is practically all bituminous. The heaviest exports are to Canada, while that country also furnishes a large share of the imports. The imports are mainly on the Pacific Coast.

CHEMICALS

NEW YORK—Mar. 26

General business continues steady and fairly active.

Arsenic—The market is dull and there is very little business forward. Prices may be quoted at $4 per 100 lb., but that figure is rather nominal.

Copper Sulphate—Trade is still rather quiet, but steady. Quotations are unchanged, at $5.25 per 100 lb. for carload lots, and $5.50 for smaller parcels.

Nitrate of Soda—Trade is steady and quotations are firm at 2.62½c. per lb. for spot and April; 2.60c. for May; 2.57½c. for June; 2.55c. for July; 2.52½c. for August and later deliveries. Spring buying is rather backward.

Potash Salts—The German Potash Distributing Bureau has fixed the quantity of potash salts to be mined in 1913 at 555,570 metric tons for domestic consumption and 504,200 tons for export. These quantities exceed the allotment for 1912 by 51,000 and 21,600 tons, respectively.

Phosphates—Some phosphate rock is now being imported. A cargo of 850 tons arrived at New York last week from Connetable Island, French Guiana.

Imports and Exports of chemicals and raw materials in the United States in January were as follows:

	Imports		Exports	
	1912	1913	1912	1913
Arsenic, lb.	445,099	754,093	.....	.....
Copper sulphate, lb.	.....	.....	1,306,079	1,193,850
Bleach, lb.	9,414,490	6,426,217	.....	.....
Potash salts, lb.	79,184,635	63,068,895	4,000	1,132,811
Soda salts, lb.	1,040,146	1,520,451	58,205	40,298
Acetate of lime, lb.	.....	.....	4,161,248	5,564,565
Nitrate of soda, tons	44,564	57,119	382	357
Sulphate of ammonia, lb.	19,289,216	19,009,131	.....	.....
Phosphates, tons	.....	.....	105,532	69,693
Sulphur, tons	2,082	1,898	1,904	6,656
Pyrites, tons	81,034	98,007	.....	.....
Magnesite, lb.	12,114,841	40,710,565	149,440	758,700
Chrome ore, tons	94	5,000	.....	.....

Exports include reëxports of foreign material. Some phosphate rock is imported, but is not given separately in the trade returns.

Assessments

Company	Delinq	Sale	Amt.
Advance, Ida	Mar. 15	Apr. 15	$0.003
Alta, Nev	Mar. 24	Apr. 14	0.05
Bell, Ida	Mar. 12	Apr. 12	0.01
Blue Star, Wash	Mar. 7	.....	0.001
Black Horse, Ida	Mar. 8	Mar. 27	0.005
Caledonia, Nev	Apr. 9	Apr. 29	0.05
Central Eureka, Nev	Mar. 22	Apr. 26	0.02½
Challenge, Nev	Apr. 1	Apr. 22	0.05
Chollar, Nev	Mar. 31	Apr. 24	0.03
Corbin Copper, Mont	.....	Apr. 22	0.50
Crown Point, Utah	Mar. 20	Apr. 15	0.01
Great Falls, Utah	Mar. 22	Apr. 22	0.01
Michigan Cop. & Gold, Utah	Mar. 31	Apr. 22	0.01
National Copper, Ida	.....	.....	0.01
Nicodemus, Ore	Mar. 14	.....	0.05
O. K. Silver, Utah	Apr. 15	May 10	0.01
Ophir, Nev	Apr. 16	May 8	0.15
Overman, Nev	Mar. 18	Apr. 8	0.05
Pacific Quicksilver, Calif	Mar. 5	.....	0.03
Relonia M. & M., Utah	Mar. 6	Apr. 5	0.01
Seg. Belcher, Nev	Apr. 8	Apr. 29	0.02
Sierra Nevada, Nev	Apr. 2	Apr. 23	0.100
Tar Baby, Utah	Mar. 10	Apr. 7	0.0q
Tonopah Gipsy Queen, Nev.	Mar. 31	May 5	0.01
Wabash, Utah	.....	Apr. 10	0.05

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1911	1912	1913	1911	1912	1913
January	53.795	56.260	62.938	24.865	25.887	28.983
February	52.222	59.043	61.642	24.081	27.190	28.357
March	52.745	58.375	.....	24.324	26.875	.....
April	53.325	59.207	.....	24.595	27.284	.....
May	53.308	60.880	.....	24.583	28.038	.....
June	53.043	61.290	.....	24.486	28.215	.....
July	52.630	60.654	.....	24.286	27.919	.....
August	52.171	61.606	.....	24.082	28.375	.....
September	52.440	63.078	.....	24.209	29.088	.....
October	53.340	63.471	.....	24.594	29.299	.....
November	55.719	62.792	.....	25.649	29.012	.....
December	54.905	63.365	.....	25.349	29.320	.....
Year	53.304	60.835	.....	24.592	28.042	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1912	1913	1912	1913	1912	1913
January	14.094	16.488	14.337	16.767	62.760	71.741
February	14.084	14.971	14.329	15.253	62.893	65.519
March	14.698	.....	14.868	.....	65.884	.....
April	15.741	.....	15.930	.....	70.294	.....
May	16.031	.....	16.245	.....	72.352	.....
June	17.234	.....	17.443	.....	78.259	.....
July	17.190	.....	17.353	.....	76.636	.....
August	17.498	.....	17.644	.....	78.670	.....
September	17.508	.....	17.698	.....	78.762	.....
October	17.314	.....	17.661	.....	76.389	.....
November	17.326	.....	17.617	.....	76.890	.....
December	17.376	.....	17.600	.....	75.516	.....
Year	16.341	.....	16.560	.....	72.942	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN

Month	New York		London	
	1912	1913	1912	1913
January	42.529	50.298	191.519	238.273
February	12.962	48.766	195.036	220.150
March	12.577	.....	192.619	.....
April	43.923	.....	200.513	.....
May	16.063	.....	208.830	.....
June	45.815	.....	205.863	.....
July	44.519	.....	202.446	.....
August	45.857	.....	208.351	.....
September	49.135	.....	223.762	.....
October	50.077	.....	228.353	.....
November	49.891	.....	227.619	.....
December	49.815	.....	226.875	.....
Av. year	46.096	.....	209.322	.....

New York in cents per pound; London in pounds sterling per long ton.

LEAD

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	4.435	4.321	4.327	4.171	15.597	17.114
February	4.026	4.325	3.946	4.175	15.738	16.550
March	4.073	.....	4.046	.....	15.997	.....
April	4.200	.....	4.118	.....	16.331	.....
May	4.194	.....	4.072	.....	16.509	.....
June	4.392	.....	4.321	.....	17.588	.....
July	4.720	.....	4.603	.....	18.544	.....
August	4.569	.....	4.452	.....	19.655	.....
September	5.048	.....	4.924	.....	22.292	.....
October	5.071	.....	4.894	.....	20.630	.....
November	4.615	.....	4.463	.....	18.193	.....
December	4.303	.....	4.152	.....	18.069	.....
Year	4.471	.....	4.360	.....	17.929	.....

New York and St. Louis cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	6.442	6.931	6.292	6.854	26.642	26.114
February	6.499	6.239	6.349	6.089	26.661	25.338
March	6.626	.....	6.476	.....	26.048	.....
April	6.633	.....	6.483	.....	25.644	.....
May	6.679	.....	6.529	.....	25.790	.....
June	6.877	.....	6.727	.....	25.763	.....
July	7.116	.....	6.966	.....	26.174	.....
August	7.028	.....	6.878	.....	26.443	.....
September	7.454	.....	7.313	.....	27.048	.....
October	7.426	.....	7.276	.....	27.543	.....
November	7.371	.....	7.221	.....	26.804	.....
December	7.162	.....	7.081	.....	26.494	.....
Year	6.943	.....	6.799	.....	26.421	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON IN PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1912	1913	1912	1913	1912	1913
January	$15.12	$18.15	$13.32	$17.35	$14.00	$18.59
February	15.03	18.15	13.28	17.22	14.01	18.13
March	14.95	.....	13.66	.....	14.10	.....
April	15.13	.....	13.90	.....	14.15	.....
May	15.14	.....	13.90	.....	14.12	.....
June	15.15	.....	14.11	.....	14.22	.....
July	15.15	.....	14.38	.....	14.38	.....
August	15.43	.....	14.90	.....	14.85	.....
September	16.86	.....	16.03	.....	15.63	.....
October	17.90	.....	17.18	.....	17.22	.....
November	18.07	.....	17.09	.....	18.00	.....
December	18.15	.....	17.45	.....	18.73	.....
Year	$16.01	.....	$14.93	.....	$15.28	.....

STOCK QUOTATIONS

COLO. SPRINGS Mar. 25

Name of Comp.	Bid.
Acacia	.02⅜
Cripple Cr'k Con.	.01⅜
C. K. & N.	.10
Doctor Jack Pot	.07½
Elkton Con	.59½
El Paso	5.00
Findlay	.04½
Gold Dollar	‡.11⅜
Gold Sovereign	.02⅜
Isabella	.12
Jack Pot	‡.06
Jennie Sample	‡.05
Lexington	‡.008
Moon Anchor	‡.005
Old Gold	‡.02
Mary McKinney	.64⅜
Pharmacist	.01½
Portland	.98
Vindicator	.95½
Work	‡.004

SALT LAKE Mar. 25

Name of Comp.	Bid.
Beck Tunnel	.06½
Black Jack	.11½
Cedar Talisman	.01
Colorado Mining	.15
Columbus Con	.05
Crown Point	.03
Daly-Judge	6.00
Grand Central	.76
Iron Blossom	1.47½
Little Bell	‡.35
Lower Mammoth	.03
Mason Valley	5.00
May Day	.13
Nevada Hills	1.17½
New York	‡.005
Prince Con	.65
Silver King Coal'n	3.12½
Sioux Con	.03
Uncle Sam	.08½
Yankee	.10

TORONTO Mar. 25

Name of Comp.	Bid	Name of Comp.	Bid
Bailey	.09	Foley O'Brien	.35
Coniagas	7.50	Hollinger	17.12½
T. & Hudson Bay	64.00	Imperial	.04
Timiskaming	.39½	Jupiter	.44
Wettlaufer-Lor	.12	Pearl Lake	.64
Apex	‡.02½	Porcu. Gold	.26½
Crown Chartered	.01	Preston E. D.	.04
Dobie	‡.15	Rea	.30
Dome	17.50	Swastika	.14
Dome Exten	.11½	West Dome	.24½

SAN FRANCISCO Mar. 25

Name of Comp.	Clg.
COMSTOCK STOCKS	
Alta	‡.01
Belcher	‡.30
Best & Belcher	‡.03
Caledonia	‡.15
Challenge Con	‡.06
Chollar	‡.01
Confidence	‡.35
Con. Virginia	‡.20
Crown Point	‡.30
Gould & Curry	‡.03
Hale & Norcross	‡.08
Mexican	‡.72
Occidental	‡.70
Ophir	‡.17
Overman	‡.55
Potosi	‡.02
Savage	‡.04
Sierra Nevada	‡.08
Union Con	‡.11
Yellow Jacket	‡.24

Name of Comp.	Bid
MISC. NEV. & CAL.	
Belmont	6.60
Jim Butler	.69
MacNamara	.20
Midway	.51
Mont.-Tonopah	1.60
North Star	.23
West End Con	1.36¼
Atlanta	.16
Booth	.06
C.O.D. Con	.05
Comb. Frac	.06
Jumbo Extension	.26
Pitts.-Silver Peak	.54
Silver Pick	.06
St. Ives	.30
Tramp Con	.01
Argonaut	1.50
Bunker Hill	‡1.50
Central Eureka	.28
So. Eureka	2.50

N. Y. EXCH. Mar. 25

Name of Comp.	Clg.
Amalgamated	70⅝
Am. Agri. Chem	51
Am.Sm.&Ref.,com	69¾
Am. Sm. & Ref., pf.	103
Am. Sm. Sec., pf. B	83⅞
Anaconda	36¾
Batopilas Min	1⅜
BethlehemSteelpf	70¾
Chino	39¼
Federal M. & S., pf.	34
Goldfield Con	2⅞
GreatNor.,ore,,ctf.	34⅛
Guggen. Exp	44⅜
Homestake	99
Inspiration Con	16½
Miami Copper	23⅛
Nat'nalLead,com.	46⅛
National Lead, pf.	104⅛
Nev. Consol	17⅜
Phelps Dodge	197⅛
Pittsburg Coal, pf.	84⅛
Ray Con	18⅛
RepublicI&S,com.	25⅛
Republic I & S, pf.	84¾
SlossSheffi'd,com.	36½
Sloss Sheffield, pf.	90
Tennessee Copper	34½
Utah Copper	47⅞
U. S. Steel, com	61⅜
U. S. Steel, pf.	108
Va.Car. Chem., pf.	108

N. Y. CURB Mar. 25

Name of Comp.	Clg.
Barnes King	1.00
Beaver Con	.39
Braden Copper	8¾
B. C. Copper	3
Buffalo Mines	2¼
Caledonia	‡.40
Con. Ariz. Sm.	⅛
Davis-Daly	2⅛
Diam'field-Daisy	.05
Ely Con	.09
Florence	.53
Giroux	2⅞
Gold Hill Con	‡⅛
Greene Cananea	7⅞
Greenwater	.04
Internat. S. & R.	‡117
Kerr Lake	3 3/16
Keystone	‡2
La Rose	2 13/16
McKinley-Dar-Sa.	1 13/16
Min. Co. of A. new	2⅜
Motherlode Gold	‡.60
Nev. Utah M. & S.	‡.01
Nipissing Mines	9⅜
Ohio Copper	¾
Pacific Sm. & M.	3/32
Puebla S. & R.	‡2 7/16
South Live Oak	‡2
South Utah M. & S.	3/16
Standard Oil (Old)	‡1110
Stand'd Oil of N.J.	362
Stewart	1¼
Tonopah	5¾
Tonopah Ex	2⅞
Tonopah Merger	.87
Tri-Bullion	1/32
Tularosa	1/16
Union Mines	‡⅜
United Cop., pfd.	10
Yukon Gold	2 1/16

LONDON Mar. 25

Name of Com.	Clg.
Camp Bird	£0 19s 9d
El Oro	0 16 6
Esperanza	1 8 6
Mexico Mines	‡6 15 0
Oriental Con.	1 8 9
Oroville	0 7 6
Santa Gert'dis	1 6 3
Tomboy	1 7 6

N. Y. EXCH. Mar. 25

Name of Comp.	Clg.
Adventure	‡2¼
Ahmeek	280
Algomah	1
Allouez	37⅛
Am. Zinc	29⅛
Ariz. Com., ctfs.	3⅝
Bonanza	.40
Boston & Corbin	6
Butte & Balak	1¾
Calumet & Ariz	65
Calumet & Hecla	455
Centennial	14
Cliff	1½
Copper Range	44¼
Daly West	3½
East Butte	12¾
Franklin	6¾
Granby	59
Hancock	20
Hedley Gold	30¾
Helvetia	.25
Indiana	13¼
Island Cr'k, com	50
Island Cr'k, pfd	84½
Isle Royale	24¾
Keweenaw	2
Lake	15⅞
La Salle	4
Mass	4
Michigan	1
Mohawk	50
New Arcadian	2¼
New Idria Quick	4
North Butte	28⅝
North Lake	1¾
Ojibway	2
Old Dominion	48
Osceola	91
Quincy	67
Shannon	10⅛
Shattuck-Ariz	22¾
Superior	30¾
Superior & Bost	3¾
Tamarack	30
Trinity	4⅛
Tuolumne	2 13/16
U. S. Smelting	41
U. S. Smelt'g, pf.	48½
Utah Apex	1¾
Utah Con	9¾
Victoria	1
Winona	2¼
Wolverine	60½
Wyandot	1

BOSTON EXCH. Mar. 25

Name of Comp.	Clg.
Belmont	6.60
Jim Butler	.69
MacNamara	.20
Midway	.51
Mont.-Tonopah	1.60
North Star	.23
West End Con	1.36¼
Atlanta	.16
Booth	.06
C.O.D. Con	.05
Comb. Frac	.06
Jumbo Extension	.26
Pitts.-Silver Peak	.54
Silver Pick	.06
St. Ives	.30
Tramp Con	.01
Argonaut	1.50
Bunker Hill	‡1.50
Central Eureka	.28
So. Eureka	2.50

BOSTON CURB Mar. 25

Name of Comp.	Last
Alaska Gold M.	13⅜
Bingham Mines	4
Boston Ely	.63
Boswyocolo	‡.01
Butte Central	5⅜
Cactus	.10
Calaveras	21⅜
Chief Cons	1 1/16
Corbin	.70
Cortez	.35
Crown Reserve	3⅜
Eagle & Blue Bell	1
First Nat. Cop	1 1/16
Majestic	.40
Mexican Metals	.95
Moneta Porc	‡.06
Nevada-Douglas	2⅜
New Baltic	.98
Oneco	1⅜
Raven Copper	.15
Rhode Island Coal	.08
Smokey Dev	‡1½
S. W. Miami	3
South Lake	6½
Trethewey	‡.42
United Verde Ext.	60

‡Last quotation.